

Career Pathways and Skills Analysis



Programming and Development

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Introduction

This is the result of an effort to document existing opportunities for individuals to enter the computer science field in the state of Massachusetts. The source of analysis was based on both a thorough review of occupational profiles and an analysis of the skills needed to satisfy the requirements. The analysis resulted in five areas of job opportunity.

Programming and Development is one of the five areas identified as viable roles that offer the greatest opportunities in computer science for those individuals with less than a 4-year degree. This report identifies the opportunities available in the computer science field as they pertain to Programming and Development. The report identifies the skills and certifications necessary for each career opportunity identified, and maps the potential career pathways that can be realized, and any additional skills or training required for promotion.

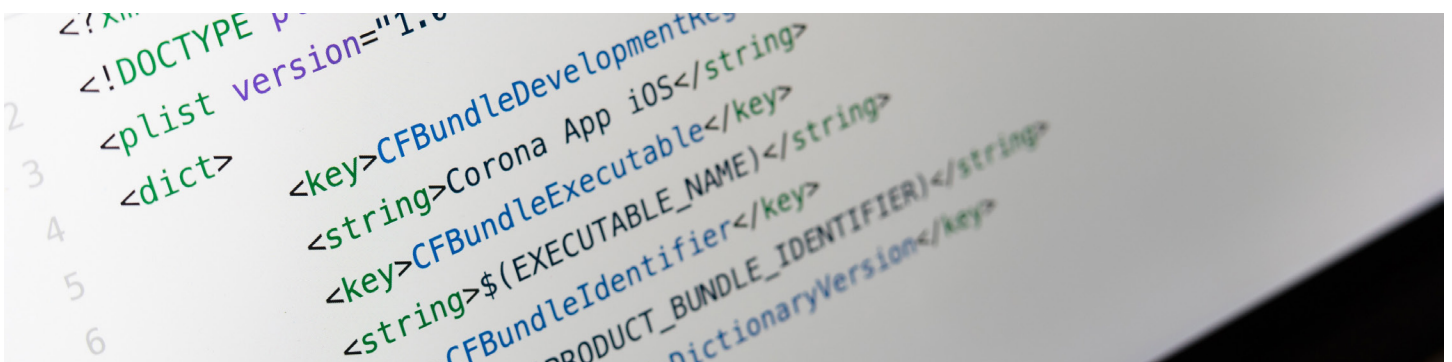
Students interested in preparing for the Programming and Development role, can learn and develop the requisite skills and can also earn relevant certifications. In the sections that follow, the report identifies the top skills and most relevant certifications. It also indicates the projected employment growth of the alternative career paths suitable for the role as well as estimated salary advancement over 2, 5 and more than 6 years in the role.

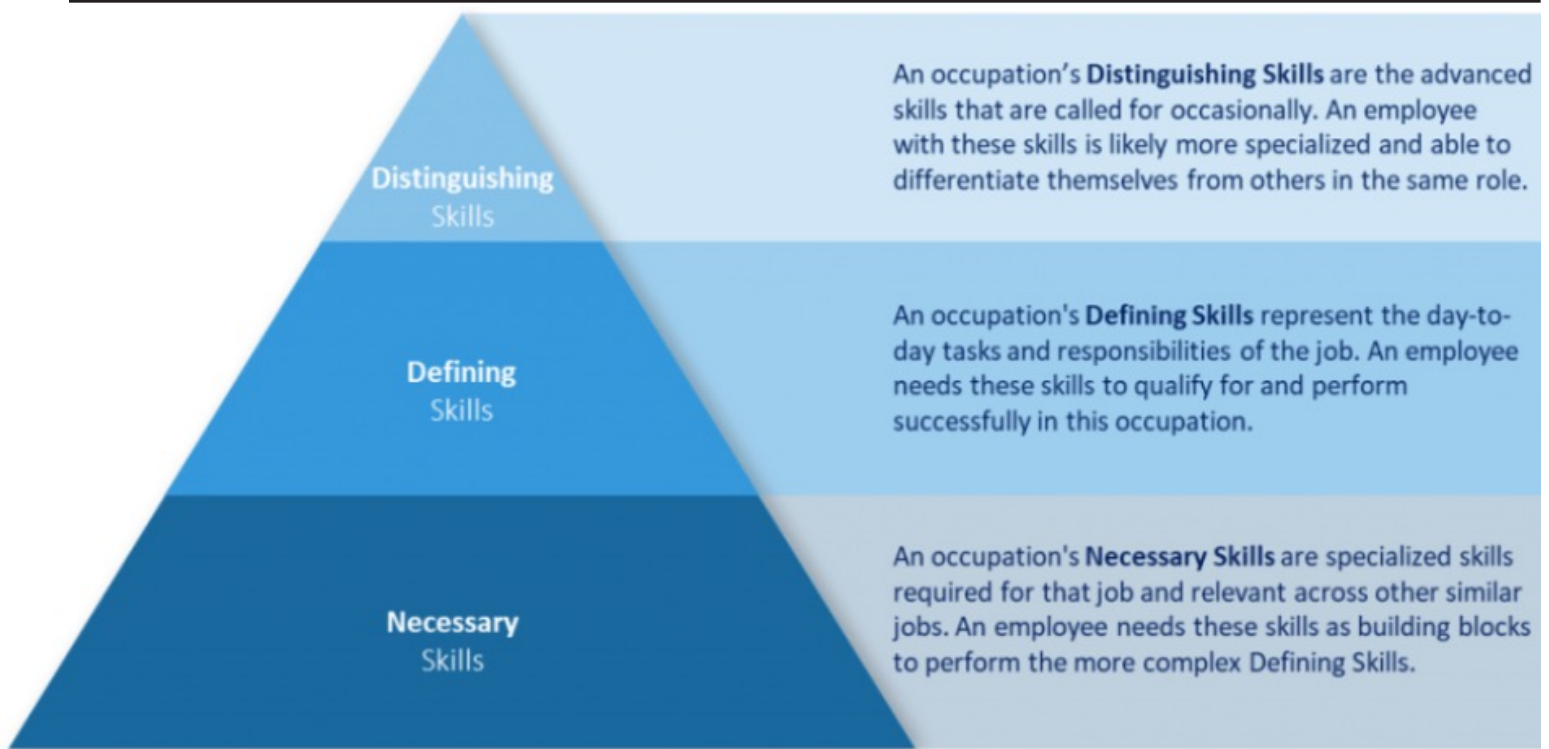
Job Opportunities in Computer Science for individuals with less than a 4-year degree

- Computer Support
- Cybersecurity
- Data Administration
- Networking and Systems
- Programming and Development

Skill Analysis

Skill analysis is done to show the extent of mastery or expertise needed to match the requirements of a job at three levels: necessary, defining, and distinguishing. Necessary skills are the set of technical abilities needed to do the particular job or something similar. Defining skills represent the sets of tasks that define and are particular to the job. Distinguishing skills are the areas of mastery or expertise that allow an individual to excel at a job. These are specialized skills called upon sporadically.





Occupation Profiles

The study of occupation profiles is designed to document the job opportunities for the Programming and Development role. This role has three starting occupations: Computer Programmer, Software Developer or Engineer, and Software QA Engineer or Tester. For each career path emerging from the Computer Programmer, Software Developer or Engineer, and Software QA Engineer or Tester occupations, the report presents salary and career advancement estimates, job openings and projected growth. The report also presents top skills and certifications associated with the occupation.

Career Pathways

Career advancement is generally seen as a transition that brings higher compensation and/or responsibility in a role that is similar to that previously held.

In order to understand likely career pathways for each of the three starting occupations of the programming and development role, likely advancement occupations were examined. This was done following Emsi | Burning Glass' Career Pathways model as well as by examining actual transitions made by individuals through analysis of Emsi | Burning Glass's resume database.

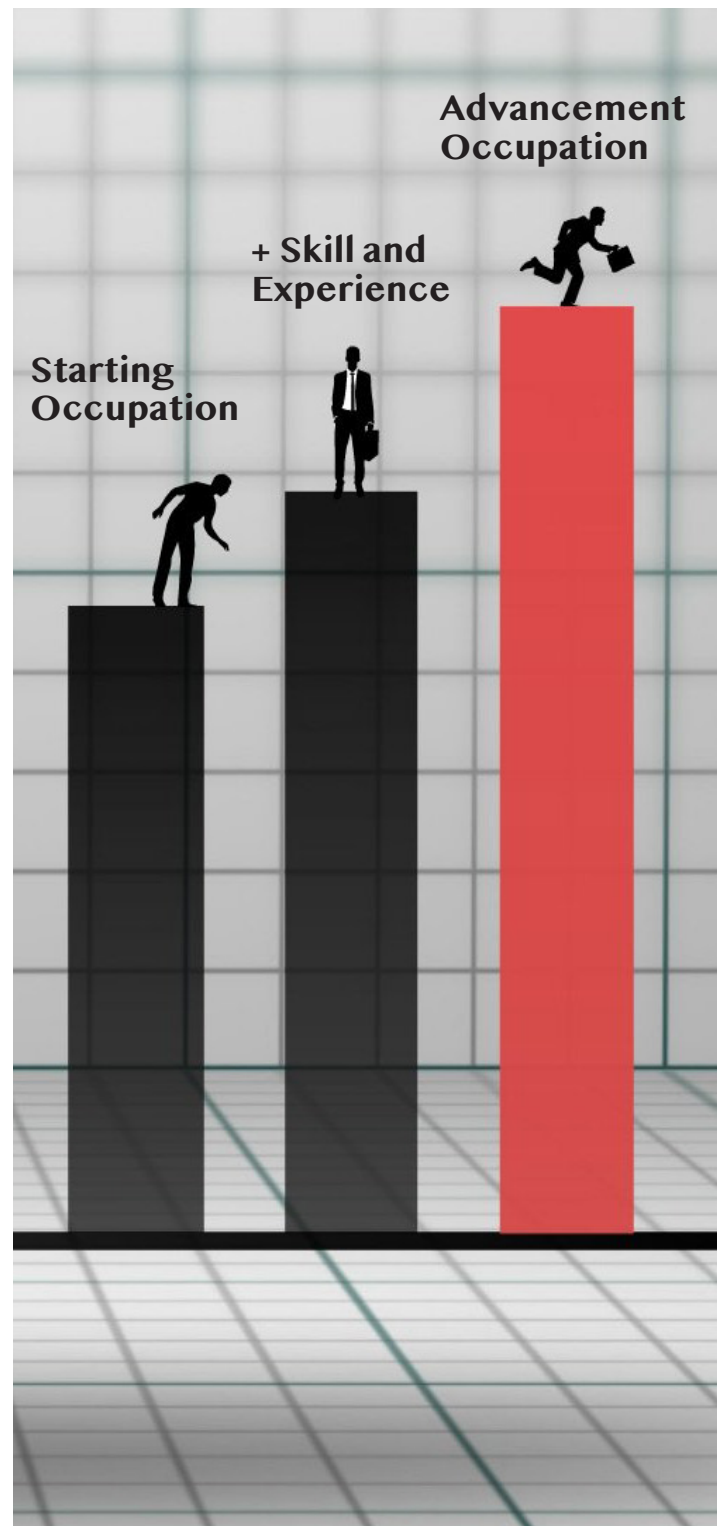


Each set of origin and destination occupations comes with a predicted salary differential and skill gap between the two occupations.

Methodology

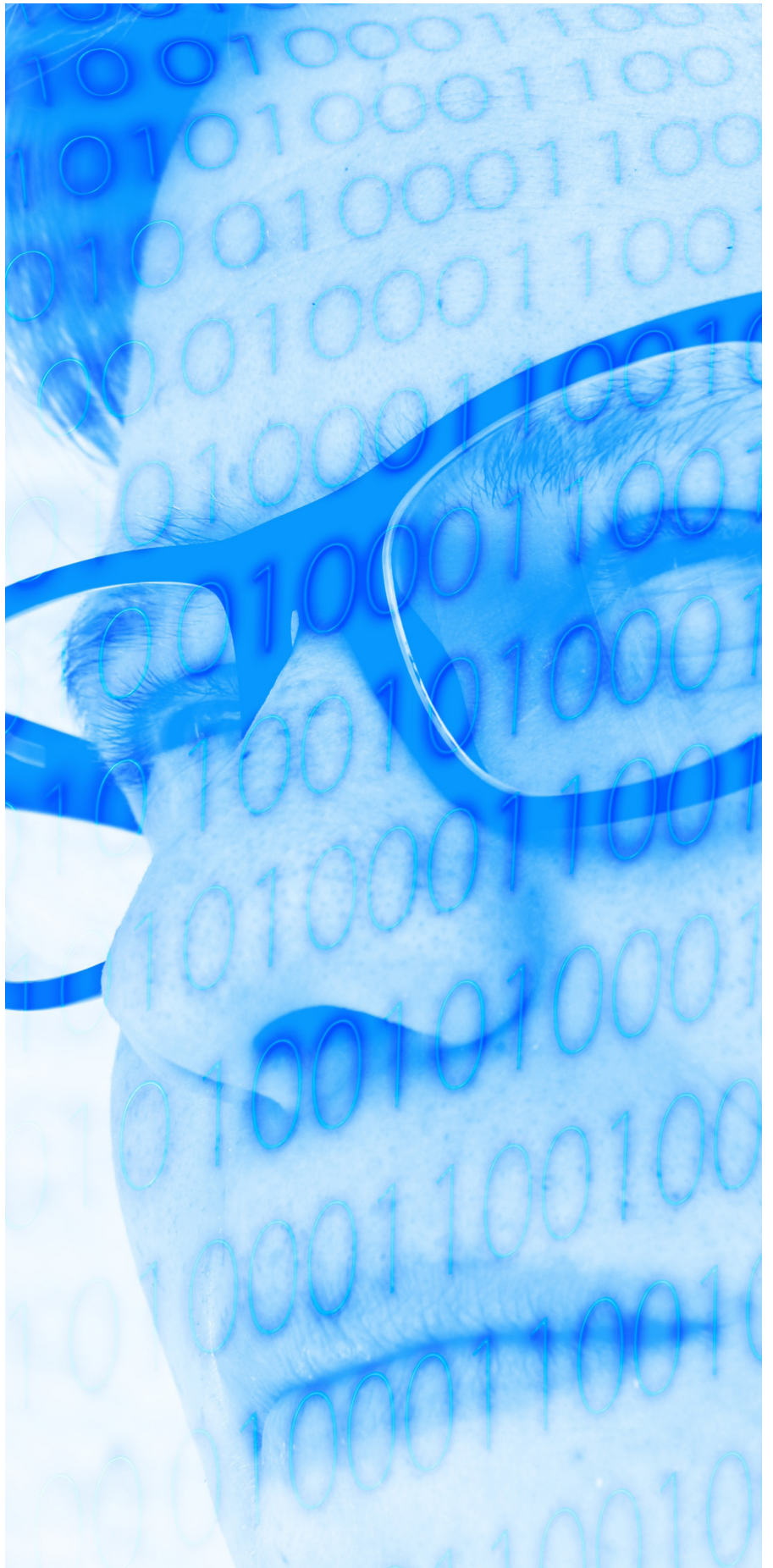
In this analysis, we use an index of similarity or ‘similarity scores’. The similarity scores for each pair of occupations have a numeric value between 0 and 1. They can be seen as a proxy measure for the feasibility of transitioning between the two jobs. Job pairs that have a similarity score of 1 can be said to have a perfect fit (and are in fact the same occupation), while job pairs with a similarity score of 0 have the most imperfect fit with no overlapping skills.

Similarity scores only indicate skills overlap and skills gaps, and do not contemplate differentials in educational attainment. While some occupations always require specific degrees or licenses, many occupations may only prefer certain education levels (however strongly) and can offer greater possibility for direct promotion.



Occupation Profile: Programming and Development

Occupation:
Computer
Programmer



Occupation Profile: Programming and Development

Occupation: Computer Programmer

Occupation

Computer programmers write and test code that allows computer applications and software programs to function properly. They turn the program designs created by analysts, software developers and engineers into instructions that a computer can follow. Computer programmers also design a graphical user interface (GUI) for an application so that non-technical users can use the software through easy, point-and-click menu options. These individuals tend to be investigative, which means they're intellectual, introspective, and inquisitive. They are curious, methodical, rational, analytical, and logical.

Growth

Computer programmer jobs are projected to have a -3.93% growth in employment. The entry level salary for this occupation is \$59,950 with a requirement of less than 2 years of experience. The mid career salary, that is jobs requiring 3 to 5 years of experience is \$88,762. The advanced career salary which requests six or more years of experience is \$103,165.

Skills

The skills shown in the table below represent the additional skills likely needed to move from the starting occupation to



-3.93%
Projected Growth

*Estimated five-year
growth in employment*



\$59,950
Entry Level Salary

*Salary for jobs requiring less
than 2 years of experience*



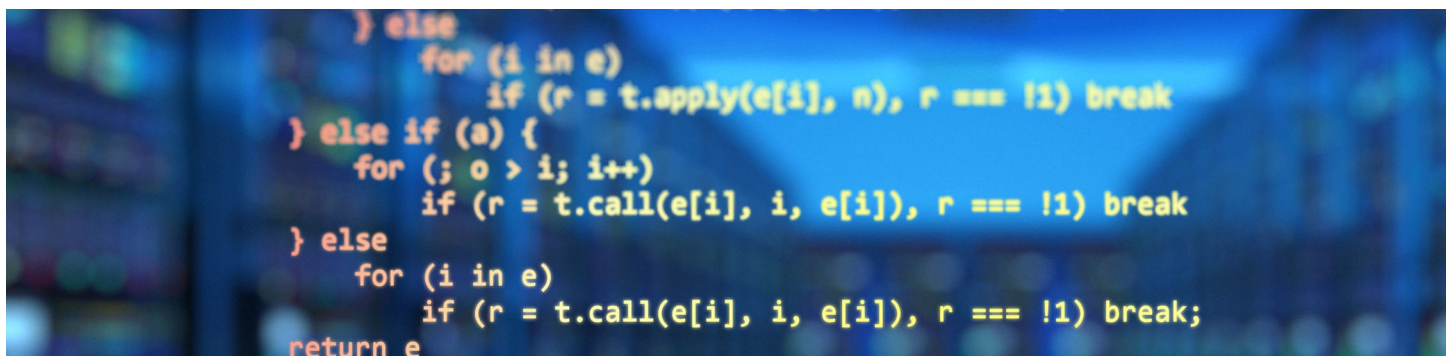
\$88,762
Mid Career Salary

*Salary for jobs requesting 3 to 5
years of experience*



\$103,165
Advanced Career Salary

*Salary for jobs requesting 6+ years
of experience*



Occupation Profile: Programming and Development

Occupation: Computer Programmer

the advancement occupation. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills include knowledge of software development, project management, Microsoft C#, scheduling, information systems, and customer service. Defining skills represent the day-to-day tasks and responsibilities of the job. They assume an increase level of technical competency. They include knowledge of SQL, Java, JavaScript, Python, and .NET. Distinguishing skills set a worker apart and come with a salary premium. Note that in this role, the prospects for growth include knowledge of SQL Server, Extensible Markup Language (XML), debugging, C++, relational databases, and systems analysis.

Certifications

- Security Clearance
- Driver's License
- Project Management Professional (PMP)

ing and directing projects and teams.

Certifications

This occupation requests in addition to security clearance and a driver's license, the following certification: Project Management Professional (PMP) certification. This certification validates the individual's competence to perform in the role of a project manager, lead-

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Name	Percent of Postings Requesting Skill	Skill Name	Percent of Postings Requesting Skill	Skill Name	Percent of Postings Requesting Skill
Software Development	19%	SQL	26%	SQL Server	8%
Project Management	14%	Java	20%	Extensible Markup Language (XML)	7%
Microsoft C#	12%	JavaScript	15%	Debugging	7%
Scheduling	11%	Python	10%	C++	7%
Information Systems	11%	.NET	10%	Relational Databases	7%
Customer Service	10%			Systems Analysis	6%

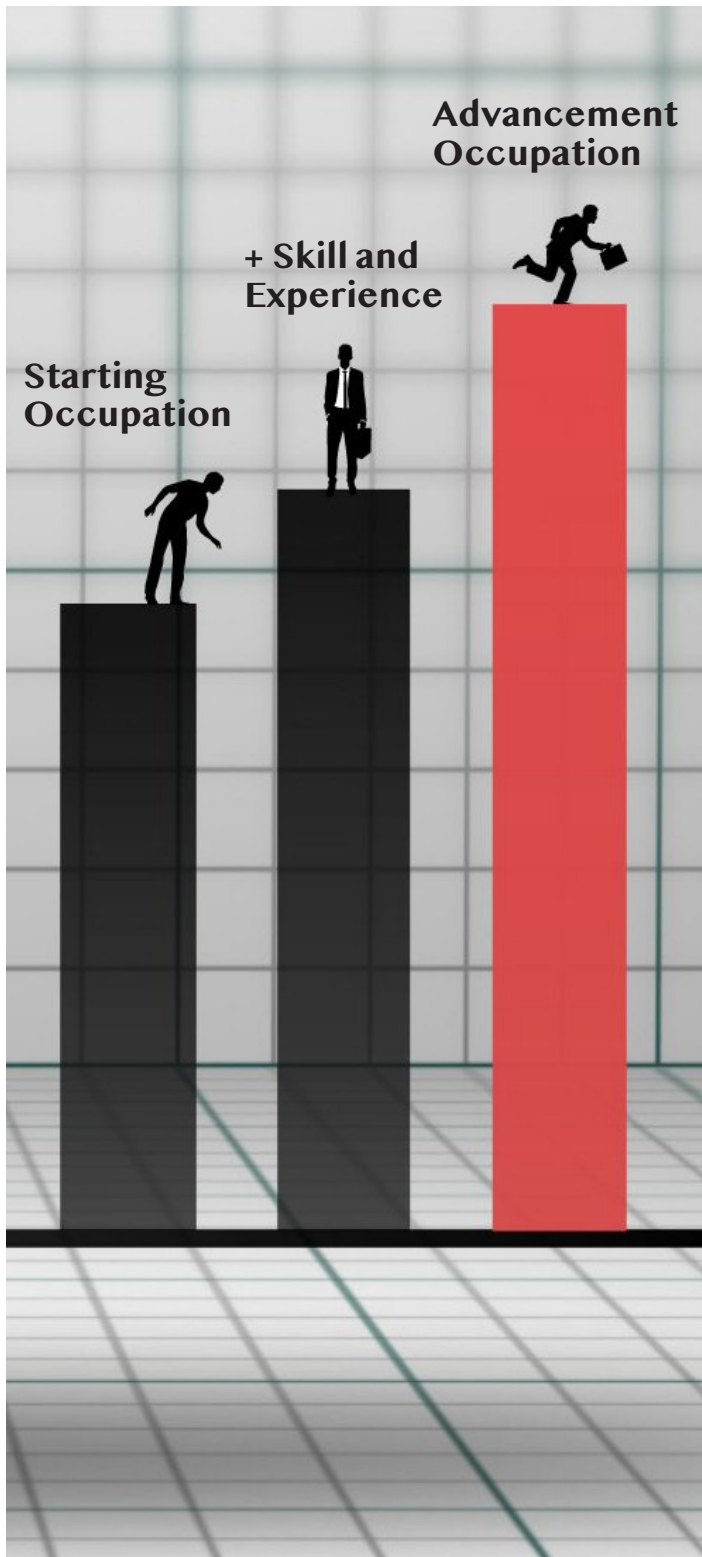
Potential Career Paths for Computer Programmer

For the starting occupation of computer programmer, we identify possible next step occupations. These occupations come with an increase in compensation and require additional skills and in some cases certifications. These skills may be learned on the job at the initial position held or can be learned in advance.

In the pages that follow, we provide for each Advancement Occupation, skill gaps, cer-

tifications, salary and workforce information. With this information, students, educators, and policy makers can see the paths a worker could take from the Starting Occupation to the Advancement Occupation.





Detailed
Career Pathways:

Computer
Programmer

Computer Programmer

Starting Occupation



Data Engineer

Advancement Occupation

Advancement Occupation

Data engineers are responsible for finding trends in data sets and developing algorithms to help make raw data more useful. This role requires a significant set of technical skills, but data engineers also need communication skills to work across departments to understand what organization leaders want to gain from existing large datasets. These individuals are comfortable with the use of mathematical or statistical skills to develop, test or validate models from available datasets. But they also have the ability to convey the results of their data analysis in visual or summary form. Most importantly, data engineers are skilled database programmers who can develop efficient data pipelines, that is, services or actions to process heterogeneous data in several useful steps.

Growth

The similarity score between data engineer and the starting occupation is 0.431 and the average salary differential is \$34,018. While the projected 5-year employment growth for computer programmer is -3.93%, data engineer's projected 5-year growth is higher at 2.56%. Average salary for the advancement occupation is \$80,464 for individuals with up to 2 years of experience; \$97,186 for those with 3 to 5 years, and \$109,854 for individuals with

0.431

Similarity Score

*Measure of relatedness
between occupations on a
scale of 0 to 1*



\$34,018

Average Salary Differential



-3.93%

Projected 5-Year Growth

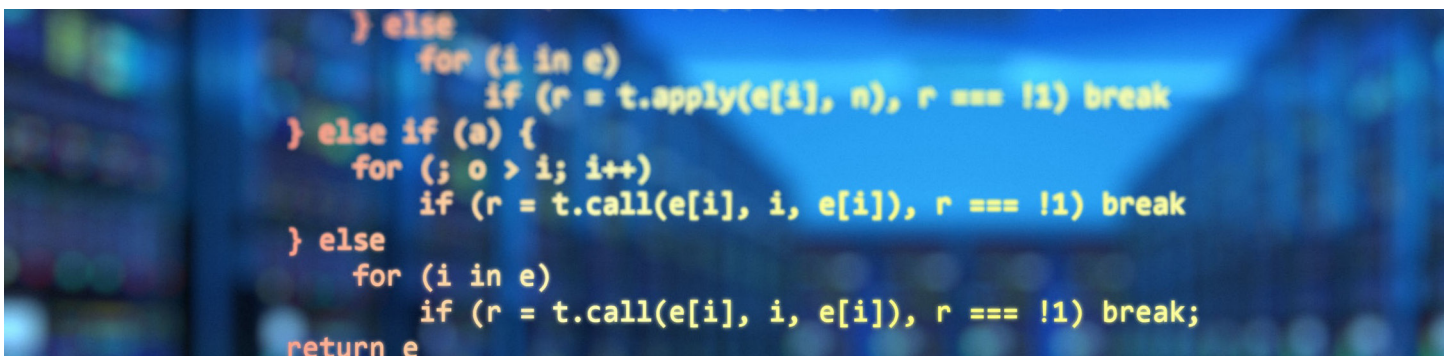
*Projected employment growth for
the Starting Occupation*



2.56%

Projected 5-Year Growth

*Projected employment growth for
the Advancement Occupation*



Computer Programmer

Starting Occupation

\$80,464

Average Salary: Advancement

Occupation with 0-2 years experience

\$97,186

Average Salary: Advancement

Occupation with 3-5 years experience

\$109,854

Average Salary: Advancement

Occupation with 6+ years experience

892

Starting Occupation Postings

731

Advancement Occupation Postings

Data Engineer

Advancement Occupation

6 or more years. There were 731 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from computer programmer to data engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for data engineer are knowledge of software development, Apache webserver, relational databases, data quality, and Tableau. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Python, SQL, big data, Extraction, Transformation and Loading (ETL), and Pipeline (computing). Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Amazon Web Services (AWS), Relational Database Management Systems (RDBMS), data warehouse processing, PIG, and AWS Elastic MapReduce (EMR).

Certifications

Computer programmer requests in addition to security clearance and a driv-



Computer Programmer

Starting Occupation



Data Engineer

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
Software Development	17%	Python	67%	Amazon Web Services (AWS)	7%
Apache Webserver	16%	SQL	66%	Relational DataBase Management System (RDBMS)	6%
Relational Databases	15%	Big Data	47%	Data Warehouse Processing	6%
Data Quality	14%	Extraction Transformation and Loading (ETL)	43%	PIG	6%
Tableau	13%	Pipeline (Computing)	38%	AWS Elastic MapReduce (EMR)	5%

er's license, the following certification: Project Management Professional (PMP) certification. This certification validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams.

The data engineer occupation commonly requests security clearance, and among others, the following two certifications: Certified Scrum Trainer (CST), a certification offered by the Scrum Alliance that enables people to teach CSM (Certified Scrum Master) and CSPO (Certified Scrum Product Owner) courses. The second certification is the Microsoft Certified Solutions Associate (MCSA). This is a certification program intended for people who seek entry-level jobs in an information technology (IT) environment. Microsoft retired the MCSA program on January 31, 2021 in favor of role-based training and certifications. However, MCSA holders will be allowed to keep it.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- Project Management Professional (PMP)

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Certified Scrum Trainer (CST)
- Microsoft Certified Solutions Associate (MCSA)

Computer Programmer

Starting Occupation



Database Architect

Advancement Occupation

Advancement Occupation

Database architects design strategies for company-wide large databases, data warehouse systems, and multidimensional networks. They set standards for database operations, programming, query processes, and security. Database architects model, design, and construct large relational databases or data warehouses. Create and optimize data models for warehouse infrastructure and workflow. They also integrate new systems with existing warehouse structure and refine system performance and functionality. These individuals are comfortable structuring complex problems through deductive reasoning, and can communicate their recommendations in simple business-like language. But most of all, they expose significant oral and reading comprehension.

Growth

The similarity score between database architect and the starting occupation is 0.46 and the average salary differential is \$21,657. While the projected 5-year employment growth for computer programmer is -3.93%, database architect's projected 5-year growth is higher at 2.99%. Average salary for the database architect occupation is \$69,185 for individuals with up to 2 years of experience; \$85,231 for those with 3 to 5 years, and \$98,672 for indi-

0.46

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$21,657

Average Salary Differential



-3.93%

Projected 5-Year Growth

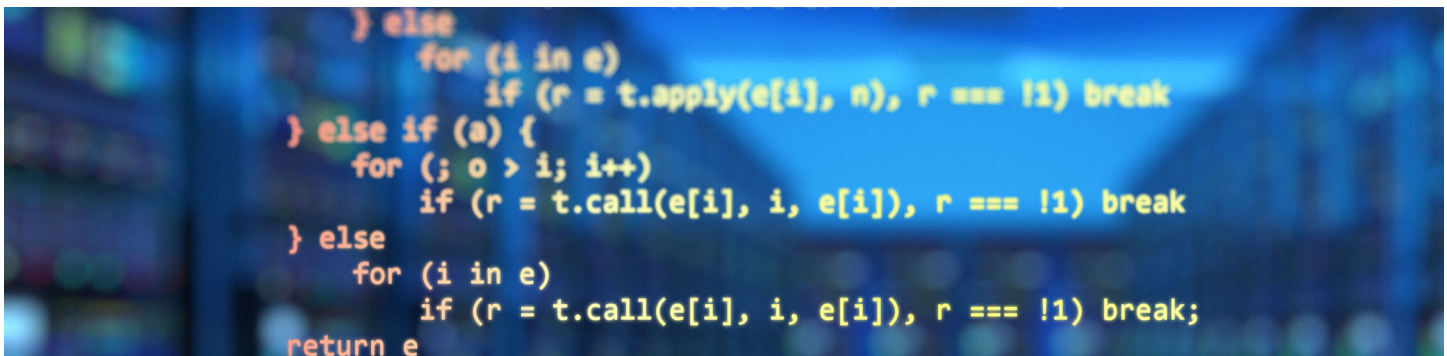
Projected employment growth for the Starting Occupation



2.99%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Computer Programmer

Starting Occupation

Database Architect

Advancement Occupation

\$69,185

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$85,231

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$98,672

Average Salary: Advancement

Occupation with 6+ years experience

892

Starting Occupation Postings

870

Advancement Occupation Postings

viduals with 6 or more years. There were 870 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from computer programmer to database architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for database architect are knowledge of data analysis, Oracle, data quality, project management, and SQL Server. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of SQL, data architecture, data warehousing, data modeling, and Extraction, Transformation and Loading (ETL). Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of ERwin, database architecture, Teradata, Master Data Management (MDM), and Virtualization.

Certifications

Computer programmer requests in ad-



Computer Programmer

Starting Occupation



Database Architect

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Data Analysis	19%
Oracle	18%
Data Quality	16%
Project Management	12%
SQL Server	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
SQL	43%
Data Architecture	33%
Data Warehousing	26%
Data Modeling	23%
Extraction Transformation and Loading (ETL)	23%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
ERwin	6%
Database Architecture	6%
Teradata	6%
Master Data Management (MDM)	5%
Virtualization	5%

dition to security clearance and a driver's license, the following certification: Project Management Professional (PMP) certification. This certification validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams.

The database architect occupation commonly requests security clearance, and among others, the following top certifications: IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management. The second is the Certified Scrum Trainer (CST), a certification offered by the Scrum Alliance that enables people to teach CSM (Certified Scrum Master) and CSPO (Certified Scrum Product Owner) courses.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- Project Management Professional (PMP)

The Advancement occupation commonly requests the following certifications:

- Security clearance
- IT Infrastructure Library (ITIL) Certification
- Certified Scrum Trainer (CST)

Computer Programmer

Starting Occupation

Biostatistician

Advancement Occupation



Advancement Occupation

Biostatisticians apply mathematics and statistical methods to answer questions in medicine, public health, biology and similar fields. In other words, biostatisticians help the medical and agricultural fields make data-driven decisions through mathematical analysis. They analyze and study the determining factors that impact the health and well-being of people, plants, and animals in order to arrive at conclusions about disorders, disease, or other health risks. These individuals are investigative, which means that they are quite inquisitive and curious. They often like to spend time alone with their thoughts. They also tend to be conventional, meaning that they are usually detail-oriented and organized, and like working in a structured environment.

Growth

The similarity score between biostatistician and the starting occupation is 0.463 and the average salary differential is \$14,875. While the projected 5-year employment growth for computer programmer is -3.93%, biostatistician's projected 5-year growth is considerably higher at 9.22%. Average salary for the biostatistician occupation is \$59,950 for individuals with up to 2 years of experience; \$88,762 for those with 3 to 5 years, and \$103,165 for individ-

0.463

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$14,875

Average Salary Differential



-3.93%

Projected 5-Year Growth

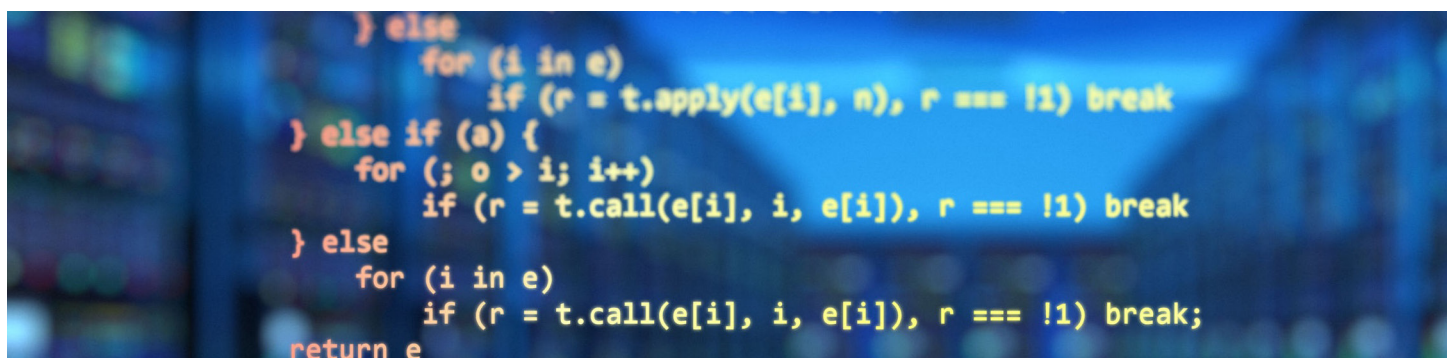
Projected employment growth for the Starting Occupation



9.22%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Computer Programmer

Starting Occupation

Biostatistician

Advancement Occupation

\$59,950

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$88,762

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$103,165

Average Salary: Advancement

Occupation with 6+ years experience

892

Starting Occupation Postings

231

Advancement Occupation Postings

uals with 6 or more years. There were 231 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from computer programmer to biostatistician. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for biostatistician are knowledge of biology, project management, SQL, budgeting, and customer contact. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of biostatistics, SAS, statistics, statistical analysis, and data analysis. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of survival analysis, biomarkers, clinical data review, proteomics, and New Drug Application (NDA) review.

Certifications

Computer programmer requests in addition to security clearance and a driver's license, the following certification: Project Management Professional (PMP)



Computer Programmer

Starting Occupation



Biostatistician

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Biology	18%
Project Management	15%
SQL	15%
Budgeting	15%
Customer Contact	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Biostatistics	67%
SAS	54%
Statistics	46%
Statistical Analysis	45%
Data Analysis	41%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Survival Analysis	6%
Biomarkers	6%
Clinical Data Review	6%
Proteomics	5%
New Drug Application (NDA) Review	4%

certification. This certification validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams.

The biostatistician occupation commonly requests security clearance, driver's license, and among others, the following certification: SAS Certification. The SAS Institute offers a number of certifications on their popular suite of statistical software which is used in a large number of commercial and governmental contexts.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- Project Management Professional (PMP)

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- SAS Certification

Computer Programmer

Starting Occupation



Computer Scientist

Advancement Occupation

Advancement Occupation

Computer scientists apply concepts from computer science to create efficient computer-based solutions. The exact goals and responsibilities of a computer scientist vary between organizations and jobs. For example, in academia computer scientists may focus on expanding computational theory as well as educating the next generation of computer scientists. In various other industries these individuals will focus on finding ways to improve efficiency of real-world computer systems. Some computer scientists study and design new programming languages that are used to write software. Others explore how a machine can interact with the physical world. For example, they may create systems that control robots or design robots to have features such as information processing or sensory feedback. Working alongside computer engineers and software engineers, computer scientists should be able to effectively communicate their work to these teams, as well as to non-technical stakeholders.

Growth

The similarity score between computer scientist and the starting occupation is 0.434 and the average salary differential is \$8,741. While the projected 5-year employment growth for computer program-

0.434

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$8,741

Average Salary Differential



-3.93%

Projected 5-Year Growth

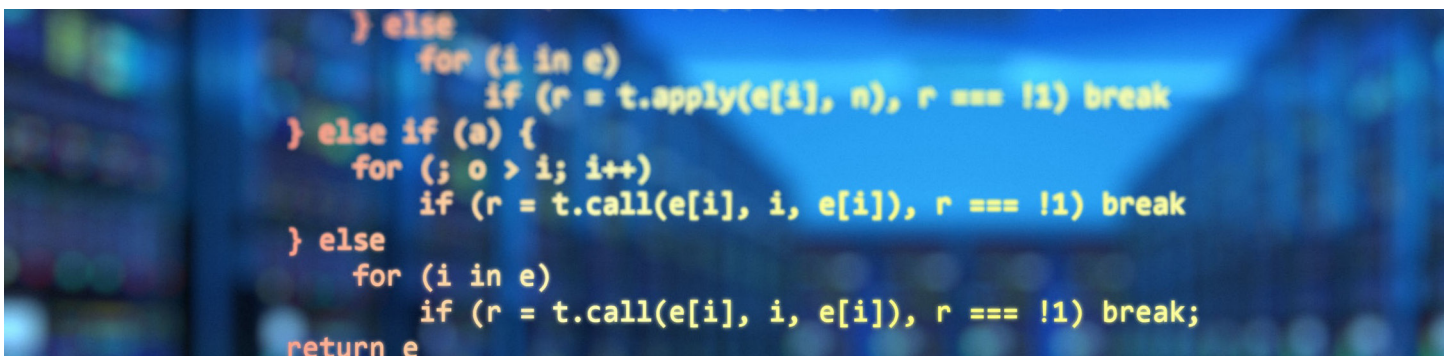
Projected employment growth for the Starting Occupation



3.73%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Computer Programmer

Starting Occupation

\$59,950

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$88,762

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$103,165

Average Salary: Advancement

Occupation with 6+ years experience

892

Starting Occupation Postings

180

Advancement Occupation Postings

Computer Scientist

Advancement Occupation

mer is -3.93%, computer scientist's projected 5-year growth is higher at 3.73%. Average salary for the computer scientist occupation is \$59,950 for individuals with up to 2 years of experience; \$88,762 for those with 3 to 5 years, and \$103,165 for individuals with 6 or more years. There were 180 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from computer programmer to computer scientist. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for computer scientist are knowledge of software development, project management, experiments, simulation, and data analysis. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Python, machine learning, data science, C++, and Artificial Intelligence (AI). Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of computer engineering, bioinformatics, natural language processing, neural networks, and image processing.



Computer Programmer

Starting Occupation



Computer Scientist

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Software Development	22%
Project Management	16%
Experiments	14%
Simulation	14%
Data Analysis	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Python	35%
Machine Learning	25%
Data Science	20%
C++	19%
Artificial Intelligence	14%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Computer Engineering	6%
Bioinformatics	5%
Natural Language Processing	4%
Neural Networks	3%
Image Processing	3%

Certifications

Computer programmer requests in addition to security clearance and a driver's license, the following certification: Project Management Professional (PMP) certification. This certification validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams.

The computer scientist occupation commonly requests the following certifications. Security clearance, Driver's license, and among others, a certification from an American Board for Engineering and Technology (ABET) accredited program.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- Project Management Professional (PMP)

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- American Board for Engineering and Technology (ABET) Accredited

Computer Programmer

Starting Occupation



UI / UX Designer/ Developer

Advancement Occupation

Advancement Occupation

UI/UX (user interface / experience) designers / developers gather user requirements, design graphic elements and build application navigation components. Specifically, they develop and test layouts, interfaces, functionality, and navigation menus to ensure compatibility and usability across browsers or devices. They may design and test interfaces that facilitate the human-computer interaction and maximize the usability of digital devices, websites, and software with a focus on aesthetics and design. These individuals have strong interpersonal, collaborative and communication skills and are comfortable working in teams and putting themselves in the shoes of their clients.

Growth

The similarity score between UI/UX designer / developer and the starting occupation is 0.48 and the average salary differential is \$11,884. While the projected 5-year employment growth for computer programmer is -3.93%, UI/UX designer / developer's projected 5-year growth is higher at 3.39%. Average salary for the UI/UX designer / developer occupation is \$70,214 for individuals with up to 2 years of experience; \$87,187 for those with 3 to 5 years, and \$101,109 for individuals with

0.48

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$11,884

Average Salary Differential



-3.93%

Projected 5-Year Growth

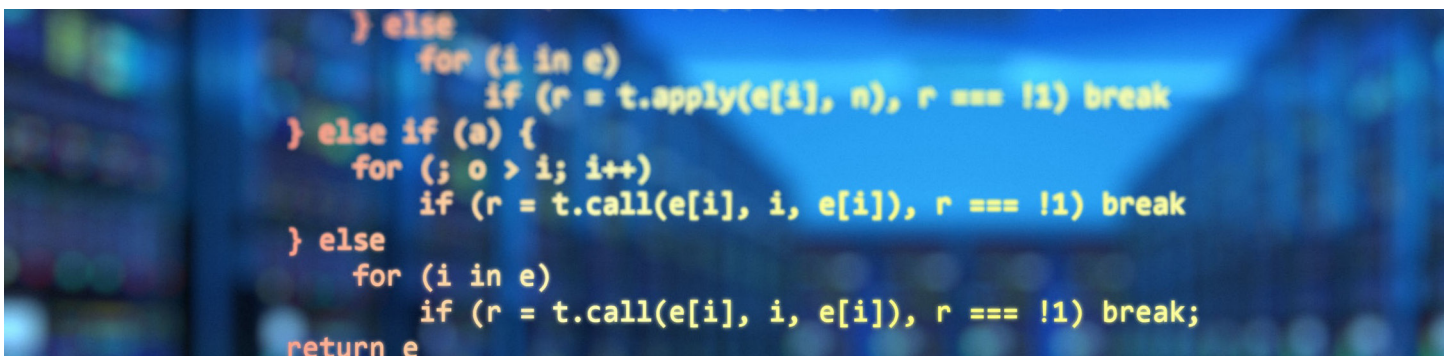
Projected employment growth for the Starting Occupation



3.39%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Computer Programmer

Starting Occupation

UI / UX Designer/ Developer

Advancement Occupation

\$70,214

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$87,187

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$101,109

Average Salary: Advancement

Occupation with 6+ years experience

892

Starting Occupation Postings

1,170

Advancement Occupation Postings

6 or more years. There were 1,170 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from computer programmer to UI/UX designer / developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for UI/UX designer / developer are knowledge of Adobe Illustrator, Adobe Acrobat, Adobe Creative Suite, process design, and web application development. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of JavaScript, UX Wireframes, User Interface (UI) Design, Adobe Photoshop, and user research. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Bootstrapping, Typescript, Typesetting, Syntactically Awesome Style Sheets (SASS), and cross-browser.



Computer Programmer

Starting Occupation



UI / UX Designer/ Developer

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Adobe Illustrator	15%
Adobe Acrobat	14%
Adobe Creative Suite	13%
Process Design	11%
Web Application Development	11%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
JavaScript	31%
UX Wireframes	29%
User Interface (UI) Design	25%
Adobe Photoshop	24%
User Research	22%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Bootstrapping	8%
TypeScript	5%
Typesetting	5%
Syntactically Awesome Style Sheets (SASS)	4%
Cross-browser	4%

Certifications

Computer programmer requests in addition to security clearance and a driver's license, the following certification: Project Management Professional (PMP) certification. This certification validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams.

The UI/UX designer or developer occupation commonly requests security clearance, driver's license, and among others a project management certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- Project Management Professional (PMP)

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- Project Management Certification

Computer Programmer

Starting Occupation



Web Developer

Advancement Occupation

Advancement Occupation

Web developers create and maintain websites. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site. They evaluate code to ensure that it is properly structured, meets industry standards, and is compatible with browsers and devices. These developers optimize website performance, scalability, and server-side code and processes. They may develop website infrastructure and integrate websites with other computer applications. These individuals are comfortable working with technology as the core of their responsibilities, but overtime, must develop a good understanding of consumer behavior, as well as collaboration skills and project management.

Growth

The similarity score between web developer and the starting occupation is 0.651 and the average salary differential is \$20,073. While the projected 5-year employment growth for computer programmer is -3.93%, web developer's projected 5-year growth is considerably higher at 2.18%. Average salary for the web developer occupation is \$70,021 for individuals with up

0.651

Similarity Score

*Measure of relatedness
between occupations on a
scale of 0 to 1*



\$20,073

**Average Salary
Differential**



-3.93%

Projected 5-Year Growth

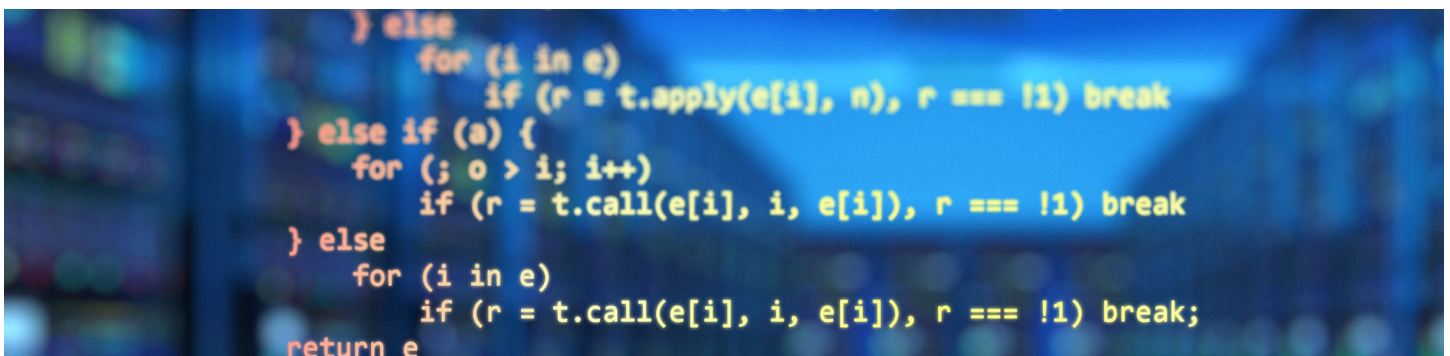
*Projected employment growth for
the Starting Occupation*



2.18%

Projected 5-Year Growth

*Projected employment growth for
the Advancement Occupation*



Computer Programmer

Starting Occupation

\$70,021

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$86,093

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$98,621

Average Salary: Advancement

Occupation with 6+ years experience

892

Starting Occupation Postings

2,947

Advancement Occupation Postings

Web Developer

Advancement Occupation

to 2 years of experience; \$86,093 for those with 3 to 5 years, and \$98,621 for individuals with 6 or more years. There were 2,947 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from computer programmer to web developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for web developer are knowledge of Microsoft C#, Python, MySQL, Ruby, and unit testing. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of JavaScript, web development, front-end development, Java, and SQL. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Flask, Joomla, AJAX, User Interface (UI) Design, and Objective C.

Certifications

Computer programmer requests in addition to security clearance and a driver's license, the following certification:



Computer Programmer

Starting Occupation



Web Developer

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft C#	18%
Python	17%
MySQL	16%
Ruby	16%
Unit Testing	16%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
JavaScript	59%
Web Development	39%
Front-end Development	32%
Java	28%
SQL	28%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Flask	7%
Joomla	6%
AJAX	6%
User Interface (UI) Design	6%
Objective C	6%

Project Management Professional (PMP) certification. This certification validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams.

The web developer occupation commonly requests security clearance, driver's license and the following certification: CompTIA Security+ a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- Project Management Professional (PMP)

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- CompTIA Security+

Computer Programmer

Starting Occupation



Computer Systems Engineer / Architect

Advancement Occupation

Advancement Occupation

Computer systems engineers or architects design and develop solutions to complex applications problems, system administration issues, or network concerns. They perform systems management and integration functions. These individuals develop software engineering, system integration, or distributed system architectures. They also collaborate with software developers to select appropriate design solutions and to ensure the compatibility of system components. These individuals are comfortable with paying attention to detail, using analytical skills and working in an atmosphere of innovation.

Growth

The similarity score between computer systems engineer or architect and the starting occupation is 0.488 and the average salary differential is \$26,751. While the projected 5-year employment growth for computer programmer is -3.93%, the advancement occupation's projected 5-year growth is higher at 2.75%. Average salary for the advancement occupation is \$60,813 for individuals with up to 2 years of experience; \$83,001 for those with 3 to 5 years, and \$99,718 for individuals with 6 or more years. There were 3,259 postings for the advancement occupation.

0.488

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$26,751

Average Salary Differential



-3.93%

Projected 5-Year Growth

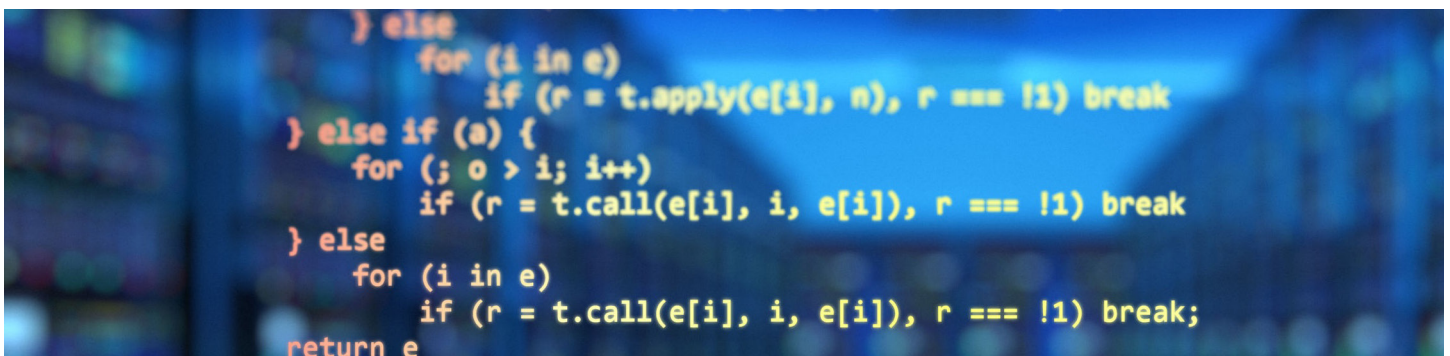
Projected employment growth for the Starting Occupation



2.75%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Computer Programmer

Starting Occupation

Computer Systems Engineer / Architect

Advancement Occupation

\$60,813

Average Salary: Advancement
Occupation with 0 - 2 years experience

\$83,001

Average Salary: Advancement
Occupation with 3 - 5 years experience

\$99,718

Average Salary: Advancement
Occupation with 6+ years experience

892

Starting Occupation Postings

3,259

Advancement Occupation Postings

Skills

The skills in the following table represent the additional skills likely needed to move from computer programmer to computer systems engineer or architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for this occupation are knowledge of Python, software development, SQL, project management, and software engineering. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of systems engineering, Linux, Java, DevOps, and system architecture. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of UNIX, Windows Server, Continuous Integration (CI), firmware, and hardware and software configuration.

Certifications

Computer programmer requests in addition to security clearance and a driver's license, the following certification: Project Management Professional (PMP) certification. This certification validates



Computer Programmer

Starting Occupation



Computer Systems Engineer / Architect

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Python	19%
Software Development	17%
SQL	14%
Project Management	11%
Software Engineering	11%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Systems Engineering	46%
Linux	20%
Java	17%
DevOps	12%
System Architecture	12%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
UNIX	8%
Windows Server	6%
Continuous Integration (CI)	5%
Firmware	4%
Hardware and Software Configuration	4%

the individual's competence to perform in the role of a project manager, leading and directing projects and teams.

The computer systems engineer or architect occupation commonly requests security clearance and among others, the following top certifications: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career; and Certified Information Systems Security Professional (CISSP), a certification designed to validate information security work experience and a working knowledge of security principles and practices. CISSP is utilized to demonstrate that a security professional is able to design, engineer, implement, and run an information security program.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- Project Management Professional (PMP)

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- CompTIA Security+
- Certified Information Systems Security Professional (CISSP)

Computer Programmer

Starting Occupation



Business Intelligence Architect / Developer

Advancement Occupation

Advancement Occupation

Business Intelligence Architects/ Developers are responsible for designing and developing BI solutions, overseeing the implementation of these types of systems and also their ongoing maintenance. They are in charge of developing, deploying, and maintaining BI interfaces. Those include query tools, data visualization and interactive dashboards, ad hoc reporting, and data modeling tools. These individuals are comfortable working with large amounts of data and deriving insights from their analysis. Some individuals may be more comfortable presenting and communicating results to others. But in either case, they are good at examining multiple sources of data and then making accurate conclusions about them. These individuals are naturally inquisitive and over time, develop a great deal of forward-thinking vision.

Growth

The similarity score between business intelligence architect/ developer and the starting occupation is 0.611 and the average salary differential is \$26,968. While the projected 5-year employment growth for computer programmer is -3.93%, business intelligence architect/ developer's projected 5-year growth is higher at 6.30%. Average salary for the business intel-

0.611

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$26,968

Average Salary Differential



-3.93%

Projected 5-Year Growth

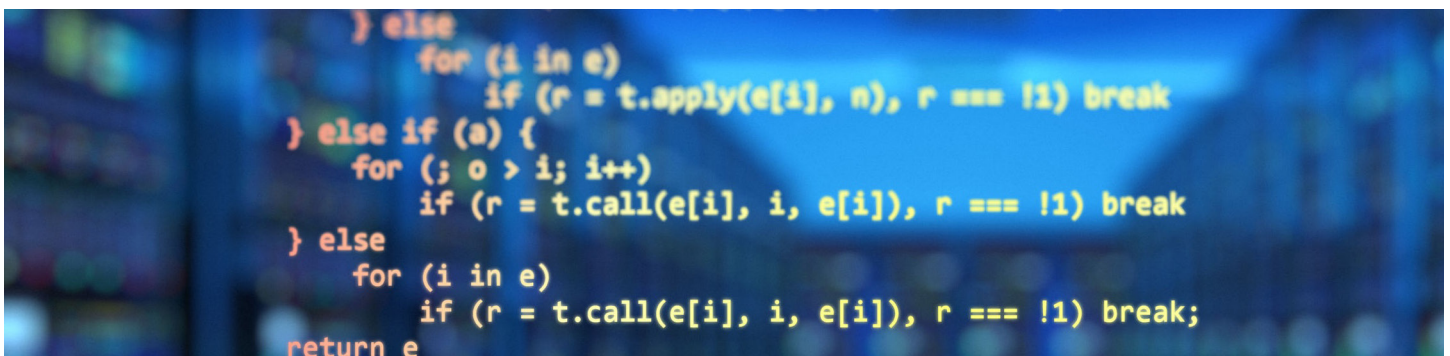
Projected employment growth for the Starting Occupation



6.30%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Computer Programmer

Starting Occupation

\$70,639

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$87,647

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$101,639

Average Salary: Advancement

Occupation with 6+ years experience

892

Starting Occupation Postings

855

Advancement Occupation Postings

Business Intelligence Architect / Developer

Advancement Occupation

Business intelligence architect/ developer occupation is \$70,639 for individuals with up to 2 years of experience; \$87,647 for those with 3 to 5 years, and \$101,639 for individuals with 6 or more years. There were 855 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from computer programmer to business intelligence architect/ developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for business intelligence architect/ developer are knowledge of JavaScript, software development, business process, Oracle, and Microsoft Power BI. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Salesforce, Salesforce Development, SQL, Salesforce Visualforce, and Salesforce Lightning. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Microsoft SQL Server Integration Services (SSIS), SQL Server Reporting Services (SSRS), Informatica, data architecture, and Oracle PL/SQL.



Computer Programmer

Starting Occupation



Business Intelligence Architect / Developer

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
JavaScript	18%
Software Development	15%
Business Process	15%
Oracle	13%
Microsoft Power BI	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Salesforce	49%
Salesforce Development	39%
SQL	34%
Salesforce Visualforce	24%
Salesforce Lightning	19%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft Sql Server Integration Services (SSIS)	5%
SQL Server Reporting Services (SSRS)	5%
Informatica	5%
Data Architecture	5%
Oracle PL/SQL	4%

Certifications

Computer programmer requests in addition to security clearance and a driver's license, the following certification: Project Management Professional (PMP) certification. This certification validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams.

The business intelligence architect/ developer occupation commonly requests security clearance, and among others, the following certifications: Certified Salesforce Platform Developer. With this credential, individuals use programmatic and declarative skills to extend and customize Salesforce applications. The second is the Certified Salesforce Administrator. This certification focuses on the features and functionality used to maintain a Salesforce implementation.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- Project Management Professional (PMP)

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Certified Salesforce Platform Developer
- Certified Salesforce Administrator

Computer Programmer

Starting Occupation



Software Developer / Engineer

Advancement Occupation

Advancement Occupation

Software developers/ engineers design, and build computer programs. They identify user needs, develop the programs, test out new software, and make improvements. Some develop new applications for mobile or desktop use, while others build underlying systems software such as operating systems. They design each piece of an application or system and plan how the pieces will work together. Software developers / engineers create a variety of models and diagrams showing programmers the software code needed for an application. Working closely with computer programmers, software developers fill crucial roles not only in the computer systems industry, but also in manufacturing, finance, health services and software publishing industries. These individuals are comfortable with the uncertainties surrounding innovation and creativity. They have an ability to focus and concentrate for prolonged time periods addressing numerous and interlocking pieces. Finally, software developers / engineers are problem solvers, as they are responsible for solving the problems that occur during the development process.

Growth

The similarity score between software developer/ engineer and the starting oc-

0.733

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$22,280

Average Salary Differential



-3.93%

Projected 5-Year Growth

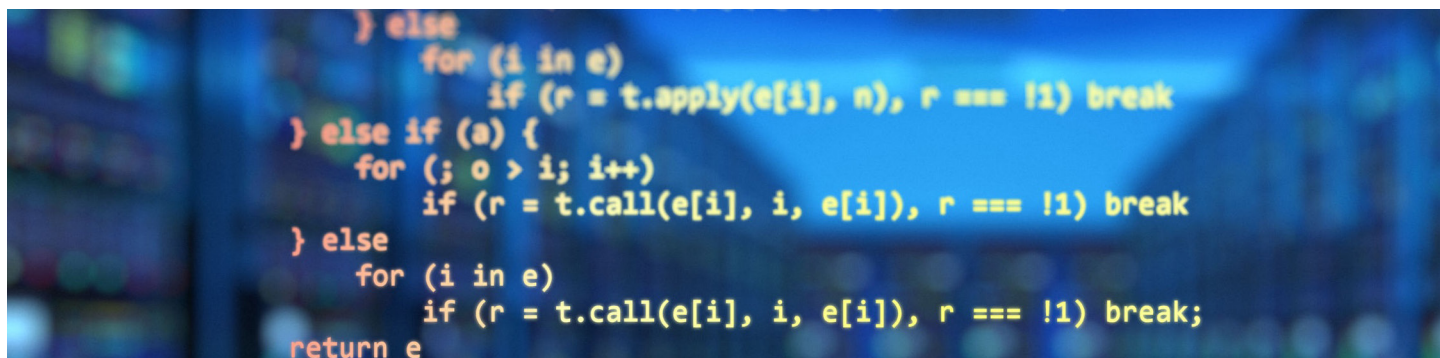
Projected employment growth for the Starting Occupation



5.84%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Computer Programmer

Starting Occupation

\$68,768

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$84,801

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$98,508

Average Salary: Advancement

Occupation with 6+ years experience

892

Starting Occupation Postings

16,139

Advancement Occupation Postings

Software Developer / Engineer

Advancement Occupation

cupation is 0.733 and the average salary differential is \$22,280. While the projected 5-year employment growth for computer programmer is -3.93%, software developer/ engineer's projected 5-year growth is considerably higher at 5.84%. Average salary for the software developer/ engineer occupation is \$68,768 for individuals with up to 2 years of experience; \$84,801 for those with 3 to 5 years, and \$98,508 for individuals with 6 or more years. There were 16,139 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from computer programmer to software developer/ engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for software developer/ engineer are knowledge of Microsoft C#, Linux, .NET, Oracle, and C++. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Java, software engineering, software development, SQL, and JavaScript. Distinguishing skills set a worker apart and come with a salary



Computer Programmer

Starting Occupation



Software Developer / Engineer

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft C#	16%
Linux	15%
.NET	13%
Oracle	12%
C++	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Java	40%
Software Engineering	34%
Software Development	33%
SQL	32%
JavaScript	26%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
JavaScript Object Notation (JSON)	7%
jQuery	6%
React Javascript	6%
Spring Boot	6%
Ruby	5%

or growth premium. For this occupation, the distinguishing skills are knowledge of JavaScript Object Notation (JSON), jQuery, React Javascript, Spring Boot, and Ruby.

Certifications

Computer programmer requests in addition to security clearance and a driver's license, the following certification: Project Management Professional (PMP) certification. This certification validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams.

The software developer/ engineer occupation commonly requests security clearance, and among others, the following certifications: IT Infrastructure Library (ITIL) Certification. Entry-level certification for IT service management. The second certification is CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- Project Management Professional (PMP)

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- IT Infrastructure Library (ITIL) Certification
- CompTIA Security+

Computer Programmer

Starting Occupation



Mobile Applications Developer

Advancement Occupation

Advancement Occupation

A mobile applications developer is a software engineer who works primarily with mobile devices, creating, programming, testing, and maintaining apps and mobile platforms across devices like smartphones, tablets and laptops. Mobile developers write programs inside of a mobile development environment using a specific programming language such as Objective C or Java. A mobile app developer will typically develop an app for a specific operating system, such as Google Android or Apple iOS, and apply the programming languages and software development environment for that platform. These individuals are usually curious, imaginative, and value variety. They are methodical, reliable and generally plan things in advance. These individuals are comfortable with the fast pace of change in the underlying development technologies.

Growth

The similarity score between mobile applications developer and the starting occupation is 0.581 and the average salary differential is \$28,654. While the projected 5-year employment growth for computer programmer is -3.93%, mobile applications developer's projected 5-year growth is higher at 5.63%. Average salary for the mobile applications developer occupation is \$70,826

0.581

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$28,654

Average Salary Differential



-3.93%

Projected 5-Year Growth

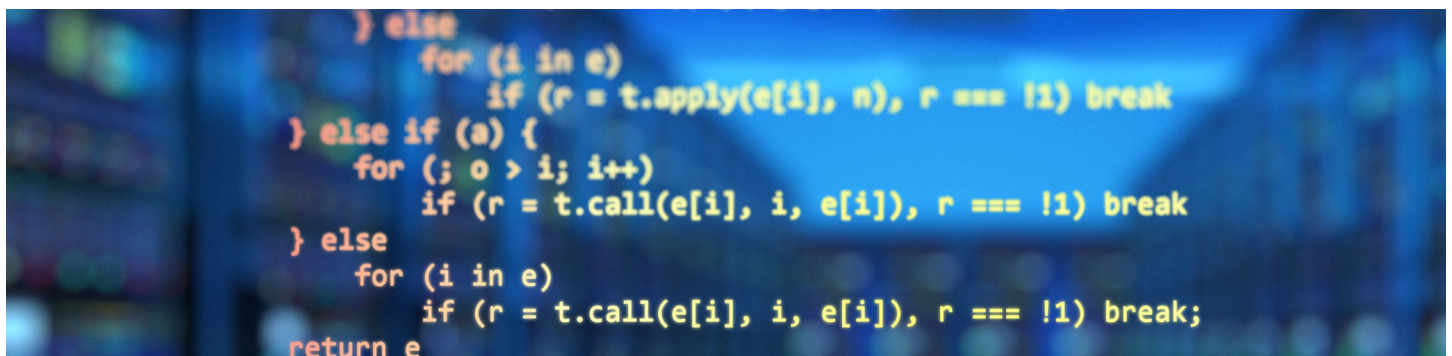
Projected employment growth for the Starting Occupation



5.63%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Computer Programmer

Starting Occupation

\$70,826

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$89,272

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$102,130

Average Salary: Advancement

Occupation with 6+ years experience

892

Starting Occupation Postings

558

Advancement Occupation Postings

Mobile Applications Developer

Advancement Occupation

for individuals with up to 2 years of experience; \$89,272 for those with 3 to 5 years, and \$102,130 for individuals with 6 or more years. There were 558 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from computer programmer to mobile applications developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for mobile applications developer are knowledge of unit testing, Object-Oriented Analysis and Design (OOAD), Javascript Object Notation (JSON), debugging, and Scrum. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Java, Swift (programming language), Android, software development, and Objective C. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Test Driven Development (TDD), User Interface (UI) Design, Gradle, React Javascript, and Microsoft Xamarin.



Computer Programmer

Starting Occupation



Mobile Applications Developer

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Unit Testing	17%
Object-Oriented Analysis and Design (OOAD)	14%
JavaScript Object Notation (JSON)	14%
Debugging	14%
Scrum	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Java	43%
Swift (Programming Language)	38%
Android	36%
Software Development	31%
Objective C	29%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Test Driven Development (TDD)	7%
User Interface (UI) Design	7%
Gradle	6%
React Javascript	6%
Microsoft Xamarin	6%

Certifications

Computer programmer requests in addition to security clearance and a driver's license, the following certification: Project Management Professional (PMP) certification. This certification validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams.

The mobile applications developer occupation commonly requests security clearance, driver's license and the following certification: TOGAF certification. The Open Group Architecture Framework (TOGAF) is a certification for IT professionals and architects that verifies their ability to simplify complex technical processes in four architecture domains: business, data, applications and technical.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- Project Management Professional (PMP)

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- TOGAF Certification

Occupation Profile: Programming and Development

Occupation:
Software
Developer /
Engineer



Occupation Profile: Programming and Development

Occupation: Software Developer / Engineer

Occupation

Software developers/ engineers design, and build computer programs. They identify user needs, develop the programs, test out new software, and make improvements. Some develop new applications for mobile or desktop use, while others build underlying systems software such as operating systems. They design each piece of an application or system and plan how the pieces will work together. Software developers / engineers create a variety of models and diagrams showing programmers the software code needed for an application. Working closely with computer programmers, software developers fill crucial roles not only in the computer systems industry, but also in manufacturing, finance, health services and software publishing industries. These individuals are comfortable with the uncertainties surrounding innovation and creativity. They have an ability to focus and concentrate for prolonged time periods addressing numerous and interlocking pieces. Finally, software developers / engineers are problem solvers, as they are responsible for solving the problems that occur during the development process.

Growth

Software developer or engineer jobs are projected to have a 5.84% growth in employment. The entry level salary for this occupation is \$89,443 with a requirement of less than 2 years of experience. The mid



5.84%
Projected Growth

*Estimated five-year
growth in employment*



\$89,443
Entry Level Salary

*Salary for jobs requiring less
than 2 years of experience*



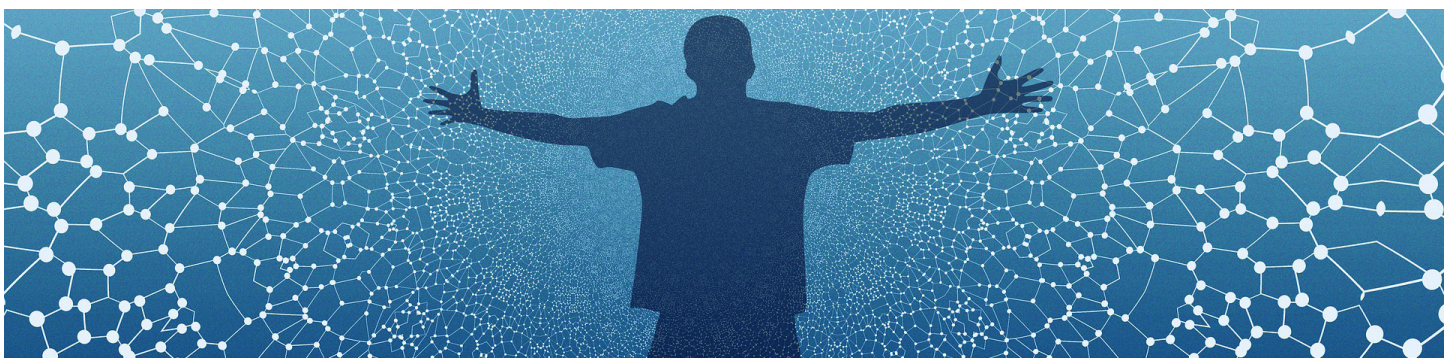
\$103,132
Mid Career Salary

*Salary for jobs requesting 3 to 5
years of experience*



\$113,399
Advanced Career Salary

*Salary for jobs requesting 6+ years
of experience*



Occupation Profile: Programming and Development

Occupation: Software Developer / Engineer

career salary, that is jobs requiring 3 to 5 years of experience is \$103,132. The advanced career salary which requests six or more years of experience is \$113,399.

Skills

The skills shown in the table below represent the additional skills likely needed to move from the starting occupation to the advancement occupation. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for software developer or engineer include knowledge of Linux, Microsoft C#, C++, Scrum, Oracle, and debugging. Defining skills represent the day-to-day tasks and responsibilities of the job. They assume an increase level of communication and direct user support. For this occupation the defining skills include knowledge of software development, software engineering, Java, SQL, JavaScript, and Python. Distinguishing skills set a worker apart and come with a salary premium. In this occupation, the distinguishing skills are knowledge of JavaScript Object Notation (JSON), jQuery, React Javascript, Test Driven Development (TDD), PostgreSQL, and Spring Boot.

Certifications

- Security Clearance
- IT Infrastructure Library (ITIL) Certification
- CompTIA Security+

Certifications

This occupation commonly requests in addition to security clearance, the following certifications: IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management. The second certification is CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career.

Necessary Skills

Skill Name	Percent of Postings Requesting Skill
Linux	19%
Microsoft C#	18%
C++	16%
Scrum	13%
Oracle	13%
Debugging	12%

Defining Skills

Skill Name	Percent of Postings Requesting Skill
Software Development	43%
Software Engineering	40%
Java	40%
SQL	30%
JavaScript	25%
Python	24%

Distinguishing Skills

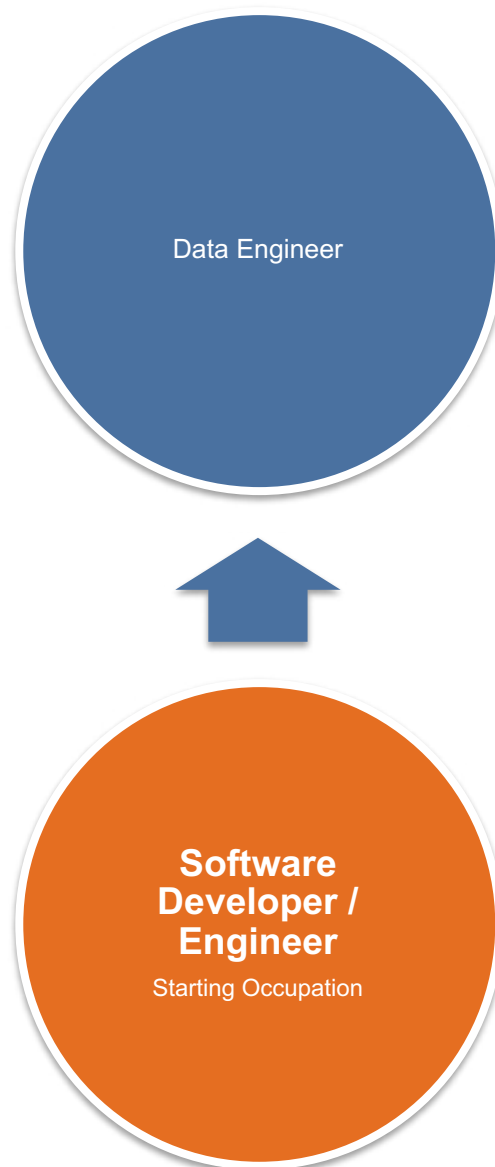
Skill Name	Percent of Postings Requesting Skill
JavaScript Object Notation (JSON)	7%
jQuery	7%
React Javascript	6%
Test Driven Development (TDD)	5%
PostgreSQL	5%
Spring Boot	5%

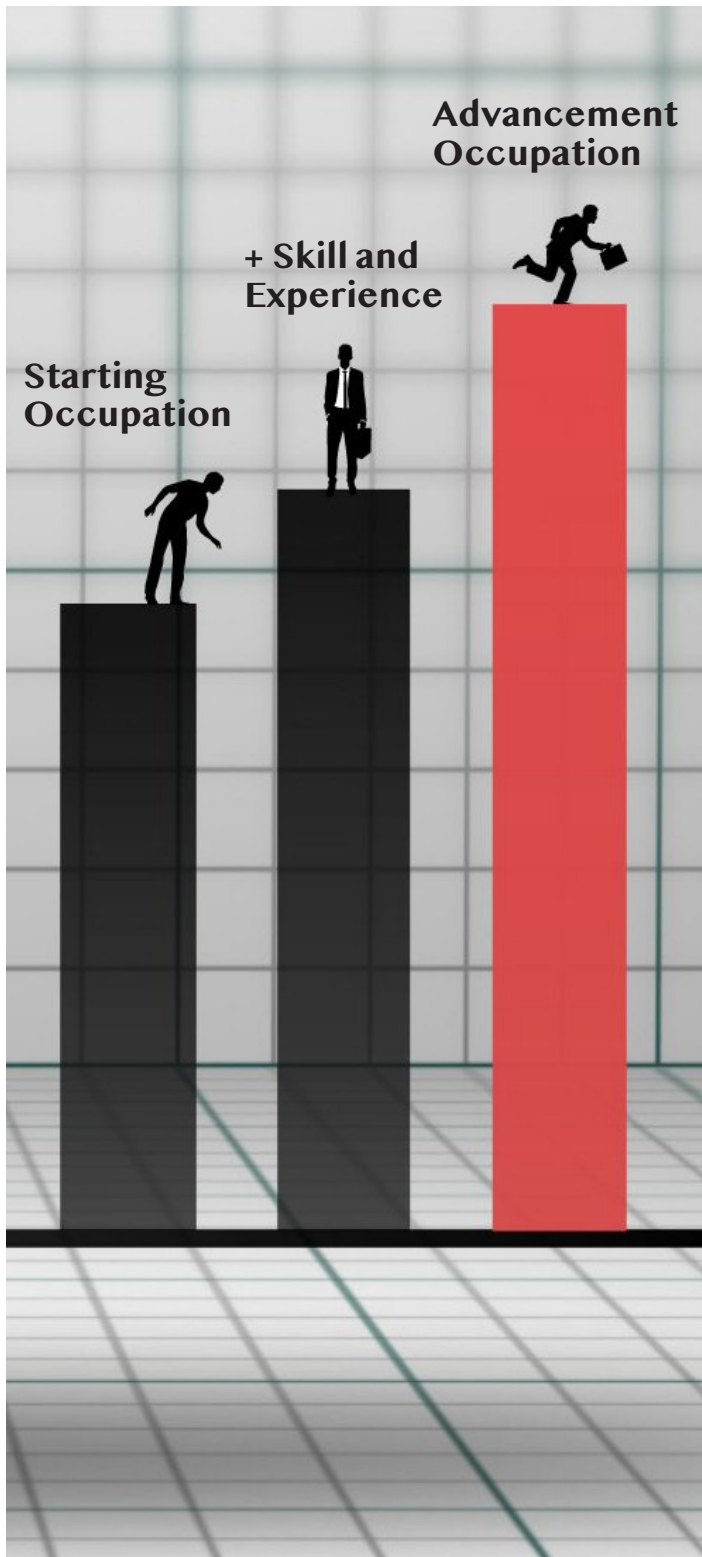
Potential Career Paths for Software Developer / Engineer

For the starting occupation of software developer or engineer, we identify possible next step occupations. These occupations come with an increase in compensation and require additional skills and in some cases certifications. These skills may be learned on the job at the initial position held or can be learned in advance.

In the pages that follow, we provide for each Advancement Occupation, skill gaps, certifi-

cations, salary and workforce information. With this information, students, educators, and policymakers can see the paths a worker could take from the Starting Occupation to the Advancement Occupation.





Detailed
Career Pathways:

Software
Developer /
Engineer

Software Developer / Engineer

Starting Occupation



Data Engineer

Advancement Occupation

Advancement Occupation

Data engineers are responsible for finding trends in data sets and developing algorithms to help make raw data more useful. This role requires a significant set of technical skills, but data engineers also need communication skills to work across departments to understand what organization leaders want to gain from existing large datasets. These individuals are comfortable with the use of mathematical or statistical skills to develop, test or validate models from available datasets. But they also have the ability to convey the results of their data analysis in visual or summary form. Most importantly, data engineers are skilled database programmers who can develop efficient data pipelines, that is, services or actions to process heterogeneous data in several useful steps.

Growth

The similarity score between data engineer and the starting occupation is 0.675 and the average salary differential is \$11,738. While the projected 5-year employment growth for software developer or engineer is 5.84%, data engineer's projected 5-year growth is lower at 2.56%. Average salary for the data engineer occupation is \$80,464 for individuals with up to 2 years of experience; \$97,186 for those

0.675

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$11,738

Average Salary Differential



5.84%

Projected 5-Year Growth

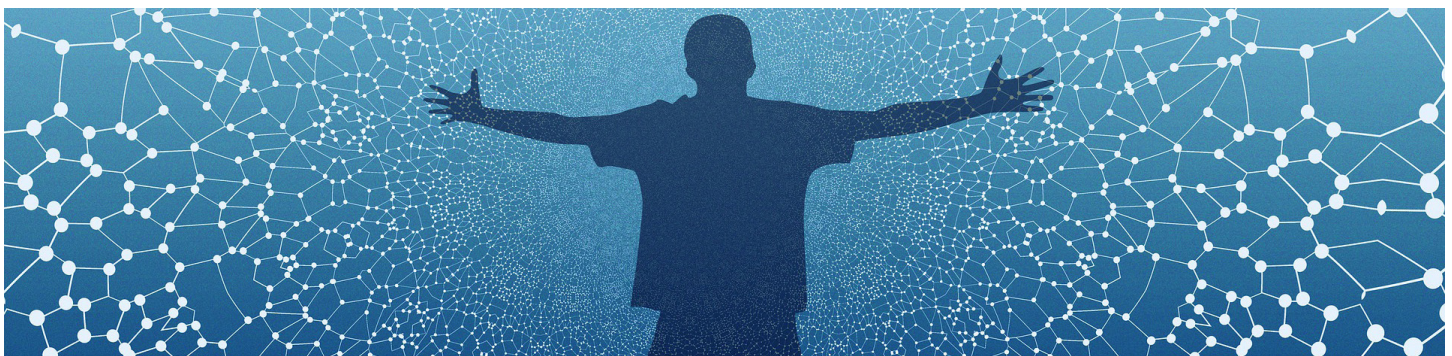
Projected employment growth for the Starting Occupation



2.56%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Software Developer / Engineer

Starting Occupation

Data Engineer

Advancement Occupation

\$80,464

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$97,186

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$109,854

Average Salary: Advancement

Occupation with 6+ years experience

16,139

Starting Occupation Postings

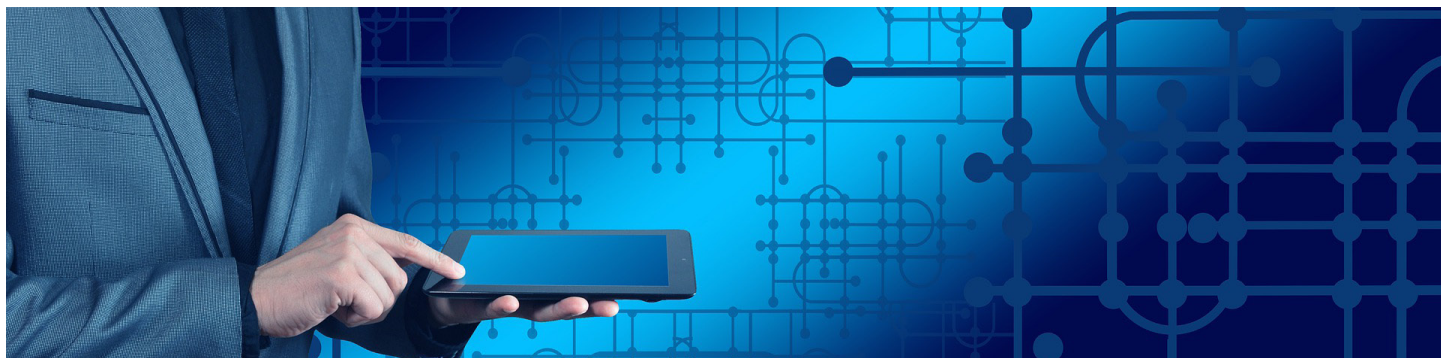
731

Advancement Occupation Postings

with 3 to 5 years, and \$109,854 for individuals with 6 or more years. There were 731 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from software developer or engineer to data engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for data engineer are knowledge of software development, Apache Webserver, relational databases, data quality, and Tableau. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Python, SQL, big data, Extraction, Transformation and Loading (ETL), and Pipeline (computing). Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Amazon Web Services (AWS), Relational Database Management Systems (RDBMS), data warehouse processing, PIG, and AWS Elastic MapReduce (EMR).



Software Developer / Engineer

Starting Occupation



Data Engineer

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
Software Development	17%	Python	67%	Amazon Web Services (AWS)	7%
Apache Webserver	16%	SQL	66%	Relational DataBase Management System (RDBMS)	6%
Relational Databases	15%	Big Data	47%	Data Warehouse Processing	6%
Data Quality	14%	Extraction Transformation and Loading (ETL)	43%	PIG	6%
Tableau	13%	Pipeline (Computing)	38%	AWS Elastic MapReduce (EMR)	5%

Certifications

The software developer/ engineer occupation commonly requests security clearance, and among others, the following certifications: IT Infrastructure Library (ITIL) Certification. Entry-level certification for IT service management. The second certification is CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career.

The data engineer occupation commonly requests security clearance, and among others, the following two certifications: Certified Scrum Trainer (CST), a certification offered by the Scrum Alliance that enables people to teach CSM (Certified Scrum Master) and CSPO (Certified Scrum Product Owner) courses. The second certification is the Microsoft Certified Solutions Associate (MCSA). This is a certification program intended for people who seek entry-level jobs in an information technology (IT) environment. Microsoft retired the MCSA program on January 31, 2021 in favor of role-based

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- IT Infrastructure Library (ITIL) Certification
- CompTIA Security+

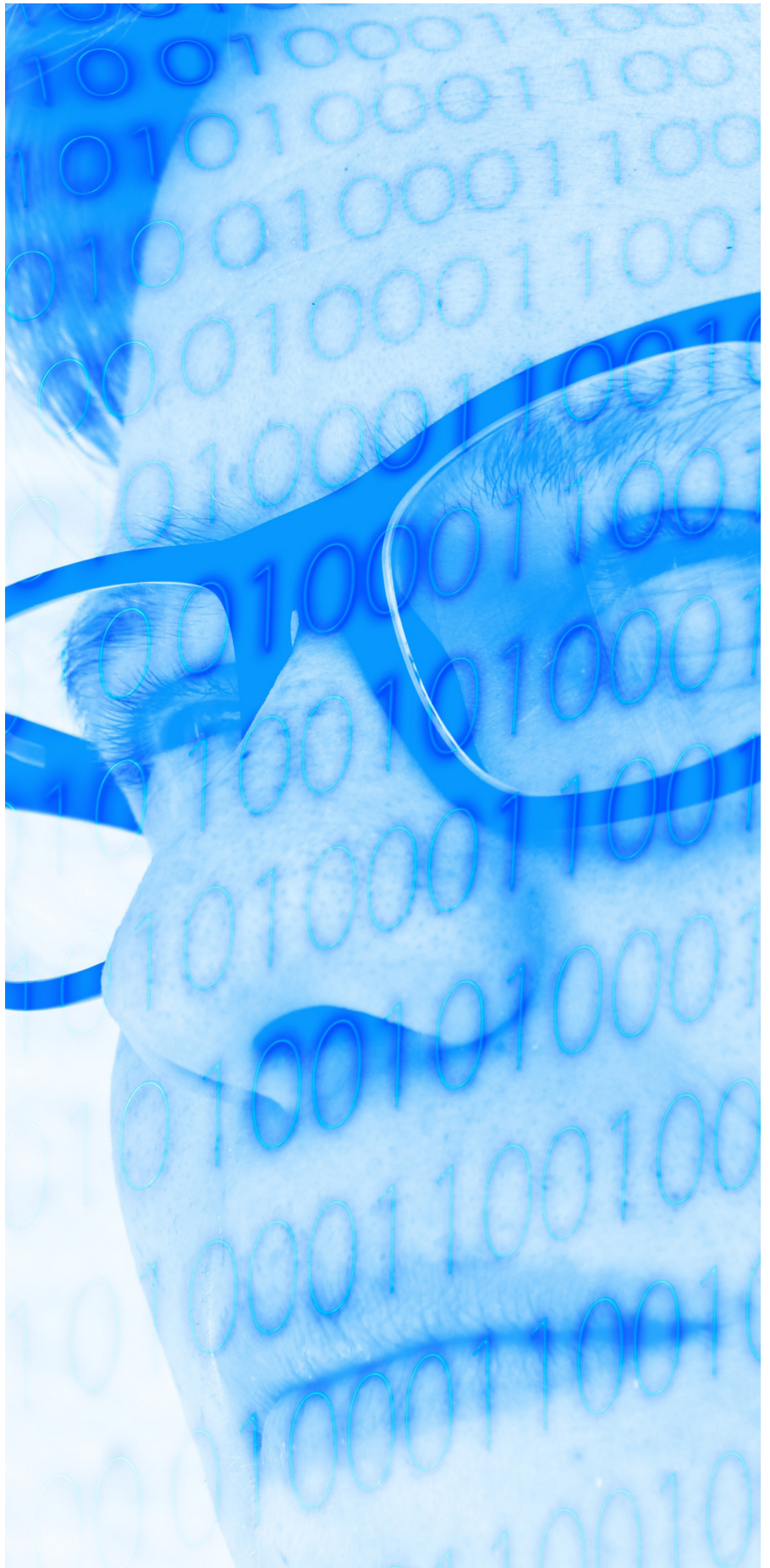
The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Certified Scrum Trainer (CST)
- Microsoft Certified Solutions Associate (MCSA)

training and certifications. However, MCSA holders will be allowed to keep it.

Occupation Profile: Programming and Development

Occupation:
Software QA
Engineer /
Tester



Occupation Profile: Programming and Development

Occupation: Software QA Engineer / Tester

Occupation

Software quality assurance engineers or testers monitor every phase of the software development process so as to ensure design quality, making sure that the software adheres to the standards set by the development company. They identify problems with applications or programs and report defects. They develop and execute software tests to identify software problems and their causes. They test system modifications to prepare for implementation and document software and application defects using a bug tracking system. Software QA engineers may participate in software design reviews to provide input on functional requirements, operational characteristics, product designs, and schedules. These individuals are comfortable working in teams and adhering to other people's timelines. But most of all, they are comfortable applying reasoning and logic to their problems solving approach.

Growth

Software QA engineering and testing jobs are projected to have 2.29% growth in employment. The entry level salary for this occupation is \$74,853 with a requirement of less than 2 years of experience. The mid career salary, that is jobs requiring 3 to 5 years of experience is \$87,660. The advanced career salary which requests six or more years of experience is \$99,749.



2.29%
Projected Growth

*Estimated five-year
growth in employment*



\$74,853
Entry Level Salary

*Salary for jobs requiring less
than 2 years of experience*



\$87,660
Mid Career Salary

*Salary for jobs requesting 3 to 5
years of experience*



\$99,749
Advanced Career Salary

*Salary for jobs requesting 6+ years
of experience*



Occupation Profile: Programming and Development

Occupation: Software QA Engineer / Tester

Skills

The skills shown in the table below represent the additional skills likely needed to move from the starting occupation to the advancement occupation. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for software QA engineer or tester include knowledge of Python, Scrum, quality management, project management, software engineering, and Systems Development Life Cycle (SDLC). Defining skills represent the day-to-day tasks and responsibilities of the job. They assume an increase level of communication and direct user support. For this occupation the defining skills include knowledge of quality assurance and control, software development, SQL, Selenium, software testing, and Java. Distinguishing skills set a worker apart and come with a salary premium. In this occupation, the distinguishing skills are knowledge of bug tracking, Apache Jmeter, test tools, unit testing, User Acceptance Testing (UAT), and black-box testing.

Certifications

This occupation commonly requests security clearance, driver's license, and

Certifications

- Security Clearance
- Driver's License
- American Society For Quality (ASQ) Certification

among others, the following certification: American Society for Quality (ASQ) Certification. ASQ certification is a formal recognition that an individual has demonstrated a proficiency within, and comprehension of, a specific body of knowledge. An ASQ Certified Software Quality Engineer understands software quality development and implementation, software inspection, testing, verification and validation; and implements software development and maintenance processes and methods.

Necessary Skills

Skill Name	Percent of Postings Requesting Skill
Python	17%
Scrum	15%
Quality Management	14%
Project Management	12%
Software Engineering	12%
Systems Development Life Cycle (SDLC)	11%

Defining Skills

Skill Name	Percent of Postings Requesting Skill
Quality Assurance and Control	62%
Software Development	27%
SQL	26%
Selenium	23%
Software Testing	23%
Java	22%

Distinguishing Skills

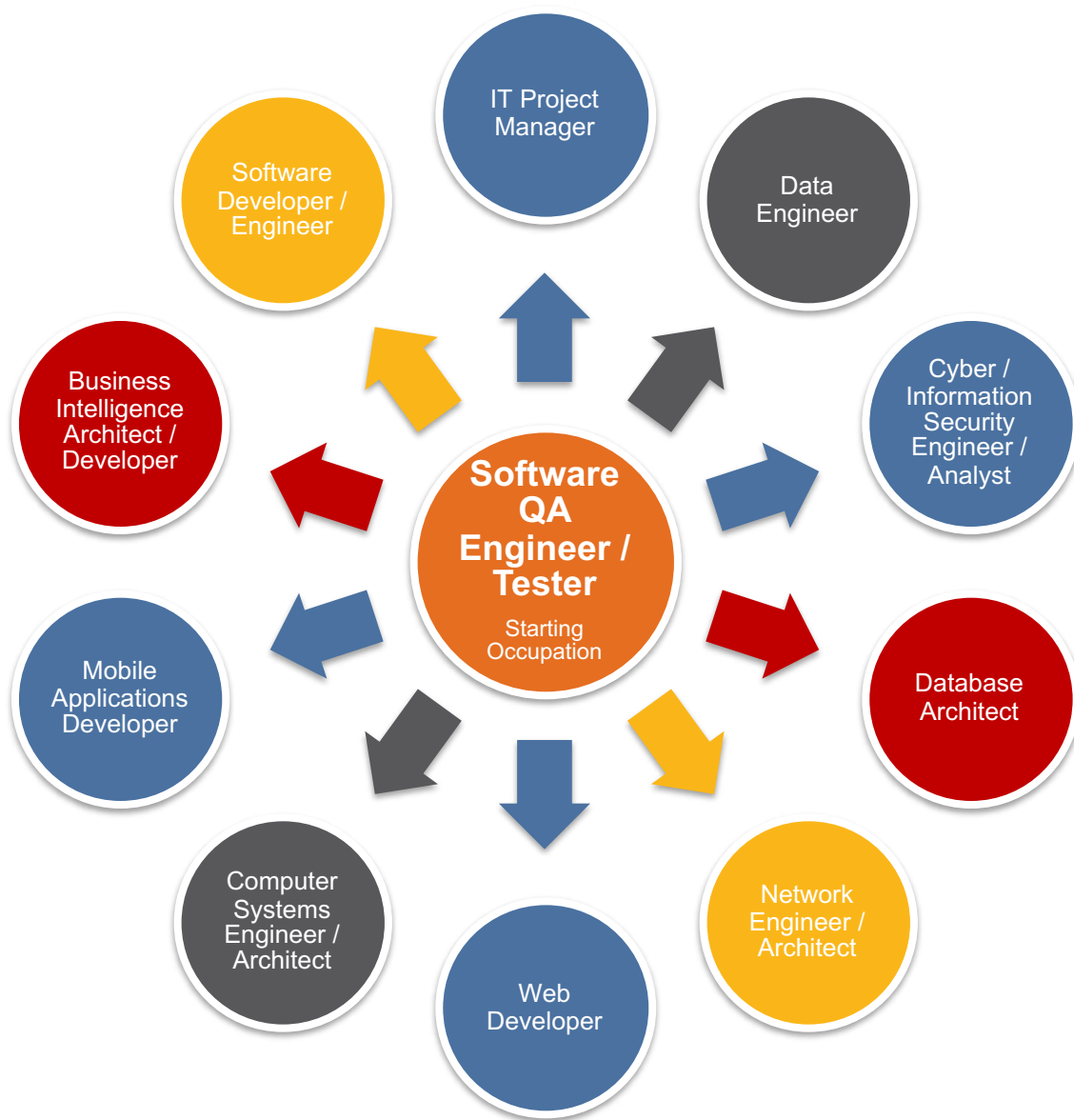
Skill Name	Percent of Postings Requesting Skill
Bug tracking	8%
Apache Jmeter	5%
Test Tools	5%
Unit Testing	5%
User Acceptance Testing (UAT)	5%
Black-box testing	4%

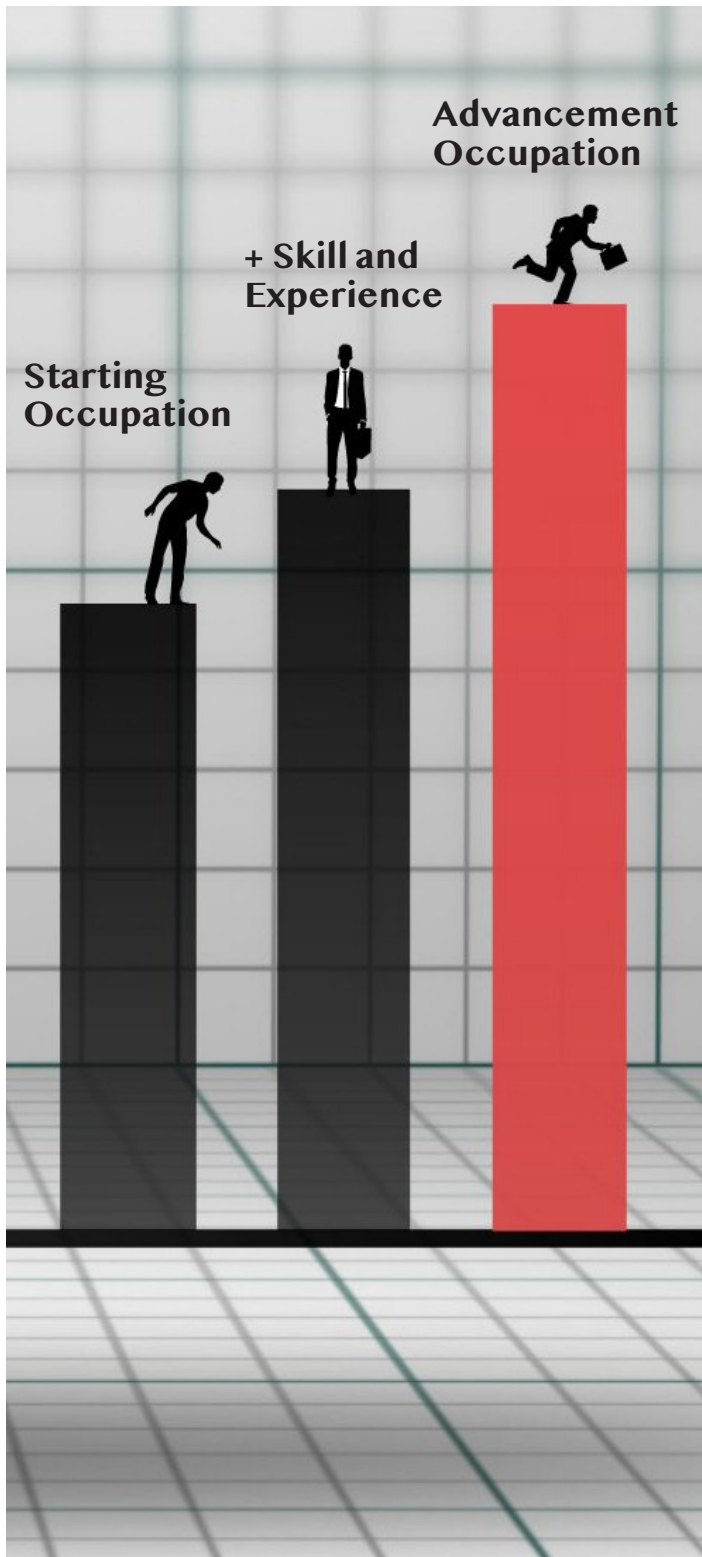
Potential Career Paths for Software QA Engineer / Tester

For the starting occupation of software QA engineer or tester, we identify possible next step occupations. These occupations come with an increase in compensation and require additional skills and in some cases certifications. These skills may be learned on the job at the initial position held or can be learned in advance.

In the pages that follow, we provide for each Advancement Occupation, skill gaps, certifi-

cations, salary and workforce information. With this information, students, educators, and policymakers can see the paths a worker could take from the Starting Occupation to the Advancement Occupation.





Detailed
Career Pathways:

Software QA
Engineer / Tester

Software QA Engineer / Tester

Starting Occupation

IT Project Manager

Advancement Occupation



Advancement Occupation

IT project managers are individuals charged with overseeing the process of planning, executing and delegating responsibilities around an organization's information technology (IT) pursuits and goals. Specifically, they help determine the systems and technology needed for specific IT projects; create detailed schedules; build a budget; identify staffing needs; and hire and manage the project staff. These individuals are comfortable in both, the technical as well as the organizational environment of the project, making them very effective as liaison between business and technical aspects of projects. They are good communicators and over time, develop an effective sense for negotiation.

Growth

The similarity score between IT project manager and the starting occupation is 0.512 and the average salary differential is \$11,616. While the projected 5-year employment growth for software QA engineer or tester is 2.29%, IT project manager's projected 5-year growth is higher at 3.12%. Average salary for the project manager occupation is \$70,136 for individuals with up to 2 years of experience; \$84,972 for those with 3 to

0.512

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$11,616

Average Salary Differential



2.29%

Projected 5-Year Growth

Projected employment growth for the Starting Occupation



3.12%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Software QA Engineer / Tester

Starting Occupation

IT Project Manager

Advancement Occupation

\$70,136

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$84,972

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$98,182

Average Salary: Advancement

Occupation with 6+ years experience

2,285

Starting Occupation Postings

3,760

Advancement Occupation Postings

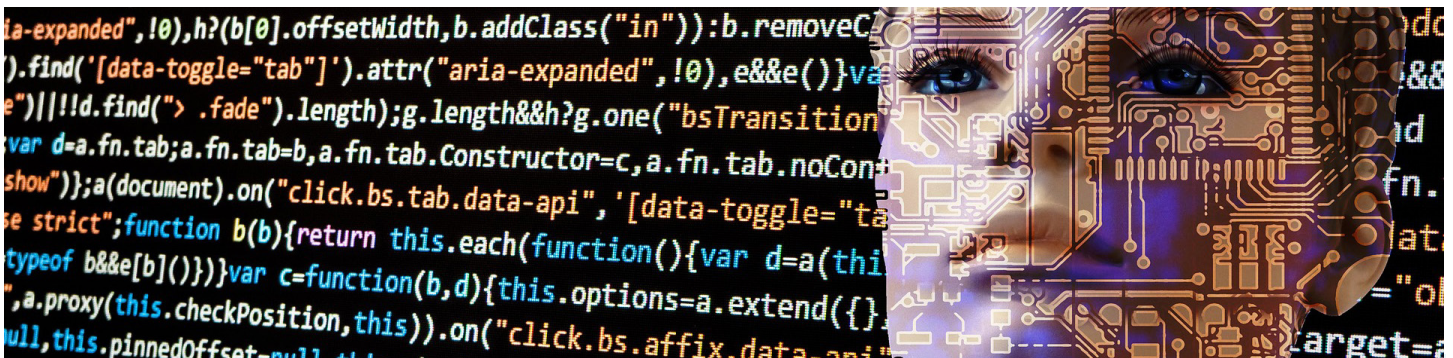
5 years, and \$98,182 for individuals with 6 or more years. There were 3,760 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from software QA engineer or tester to IT project manager. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for IT project manager are knowledge of scheduling, project planning and development skills, customer service, SQL, and quality assurance and control. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of project management, budgeting, Scrum, software development, and Scrum Master. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of product owner, IT management, DevOps, business analysis, and agile coaching.

Certifications

The software QA engineer or tester occupation commonly requests security



Software QA Engineer / Tester

Starting Occupation



IT Project Manager

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
Scheduling	19%	Project Management	58%	Product owner	7%
Project Planning and Development Skills	19%	Budgeting	29%	IT Management	6%
Customer Service	9%	Scrum	27%	DevOps	6%
SQL	9%	Software Development	20%	Business Analysis	5%
Quality Assurance and Control	8%	Scrum Master	18%	Agile coaching	5%

clearance, driver's license, and among others, the following certification: American Society for Quality (ASQ) Certification. ASQ certification is a formal recognition that an individual has demonstrated a proficiency within, and comprehension of, a specific body of knowledge. An ASQ Certified Software Quality Engineer understands software quality development and implementation, software inspection, testing, verification and validation; and implements software development and maintenance processes and methods.

The IT project manager occupation commonly requests among others, the following certifications: The first is Project Management Certification. The Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI) and Project+ from CompTIA are the best-known entry-level project management certifications. The second certification is the Project Management Professional (PMP). This certification offered by the Project Management Institute (PMI) validates the individual's competence to perform in the role of a project manager, leading and directing projects and teams. The third certi-

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- American Society For Quality (ASQ) Certification

The Advancement occupation commonly requests the following certifications:

- Project Management Certification
- Project Management Professional (PMP)
- Certified ScrumMaster (CSM)

fication is Certified Scrum Master (CSM) The Certified Scrum Master (CSM) certification, available through the Scrum Alliance, is an entry-level certification aimed at providing professionals with an awareness of the methodologies and values of Scrum, including team performance, accountability, and iterative progress.

Software QA Engineer / Tester

Starting Occupation

Data Engineer

Advancement Occupation



Advancement Occupation

Data engineers are responsible for finding trends in data sets and developing algorithms to help make raw data more useful. This role requires a significant set of technical skills, but data engineers also need communication skills to work across departments to understand what organization leaders want to gain from existing large datasets. These individuals are comfortable with the use of mathematical or statistical skills to develop, test or validate models from available datasets. But they also have the ability to convey the results of their data analysis in visual or summary form. Most importantly, data engineers are skilled database programmers who can develop efficient data pipelines, that is, services or actions to process heterogeneous data in several useful steps.

Growth

The similarity score between data engineer and the starting occupation is 0.411 and the average salary differential is \$30,760. While the projected 5-year employment growth for software QA engineer or tester is 2.29%, data engineer's projected 5-year growth is slightly higher at 2.56%. Average salary for the dataengineer occupation is \$80,464 for individuals with up to 2 years of experience; \$97,186 for those with 3 to

0.411

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$30,760

Average Salary Differential



2.29%

Projected 5-Year Growth

Projected employment growth for the Starting Occupation



2.56%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Software QA Engineer / Tester

Starting Occupation

Data Engineer

Advancement Occupation

\$80,464

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$97,186

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$109,854

Average Salary: Advancement

Occupation with 6+ years experience

2,285

Starting Occupation Postings

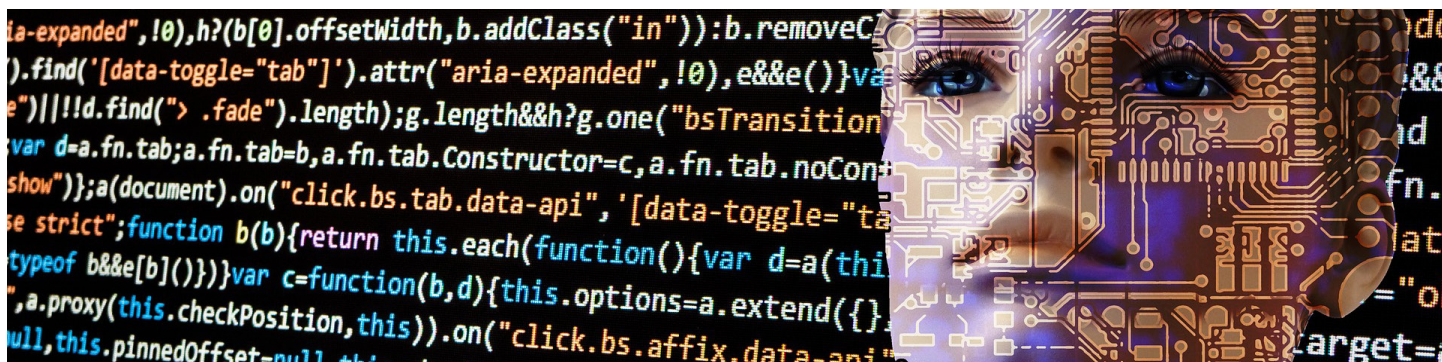
731

Advancement Occupation Postings

5 years, and \$109,854 for individuals with 6 or more years. There were 731 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from software QA engineer or tester to data engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for data engineer are knowledge of software development, Apache Webserver, relational databases, data quality, and Tableau. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Python, SQL, big data, Extraction, Transformation and Loading (ETL), and Pipeline (computing). Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Amazon Web Services (AWS), Relational Database Management Systems (RDBMS), data warehouse processing, PIG, and AWS Elastic MapReduce (EMR).



Software QA Engineer / Tester

Starting Occupation

Data Engineer

Advancement Occupation



Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
Software Development	17%	Python	67%	Amazon Web Services (AWS)	7%
Apache Webserver	16%	SQL	66%	Relational DataBase Management System (RDBMS)	6%
Relational Databases	15%	Big Data	47%	Data Warehouse Processing	6%
Data Quality	14%	Extraction Transformation and Loading (ETL)	43%	PIG	6%
Tableau	13%	Pipeline (Computing)	38%	AWS Elastic MapReduce (EMR)	5%

Certifications

The software QA engineer or tester occupation commonly requests security clearance, driver's license, and among others, the following certification: American Society for Quality (ASQ) Certification. ASQ certification is a formal recognition that an individual has demonstrated a proficiency within, and comprehension of, a specific body of knowledge. An ASQ Certified Software Quality Engineer understands software quality development and implementation, software inspection, testing, verification and validation; and implements software development and maintenance processes and methods.

The data engineer occupation commonly requests security clearance, and among others, the following two certifications: Certified Scrum Trainer (CST), a certification offered by the Scrum Alliance that enables people to teach CSM (Certified Scrum Master) and CSPO (Certified Scrum Product Owner) courses. The second certification is the Microsoft Certified Solutions Associate (MCSA). This is a certification program intended for

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- American Society For Quality (ASQ) Certification

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Certified Scrum Trainer (CST)
- Microsoft Certified Solutions Associate (MCSA)

people who seek entry-level jobs in an information technology (IT) environment. Microsoft retired the MCSA program on January 31, 2021 in favor of role-based training and certifications. However, MCSA holders will be allowed to keep it.

Software QA Engineer / Tester

Starting Occupation



Cyber / Information Security Engineer / Analyst

Advancement Occupation

Advancement Occupation

Cyber/ Information security engineers/ analysts specialize in network and IT infrastructure security. They understand cyberattacks, malware, and the behavior of cybercriminals, and actively seeks to anticipate and prevent these attacks. Their primary role is to understand company IT infrastructure in detail, monitor it at all times, and evaluate threats that could potentially breach the network, and the access to information assets. They continuously look for ways to enhance company information systems and network security and protect its sensitive information. These individuals are comfortable staying up-to-date with the changing technology world, and are very detailed oriented.

Growth

The similarity score between cyber/ Information security engineer/ analyst and the starting occupation is 0.457 and the average salary differential is \$11,622. While the projected 5-year employment growth for software QA engineer or tester is 2.29%, cyber/ Information security engineer/ analyst's projected 5-year growth is considerably higher at 8.77%. Average salary for the cyber/ Information security engineer/ analyst occupation

0.457

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$11,622

Average Salary Differential



2.29%

Projected 5-Year Growth

Projected employment growth for the Starting Occupation



8.77%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Software QA Engineer / Tester

Starting Occupation

Cyber / Information Security Engineer / Analyst

Advancement Occupation

\$58,383

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$79,154

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$95,250

Average Salary: Advancement

Occupation with 6+ years experience

2,285

Starting Occupation Postings

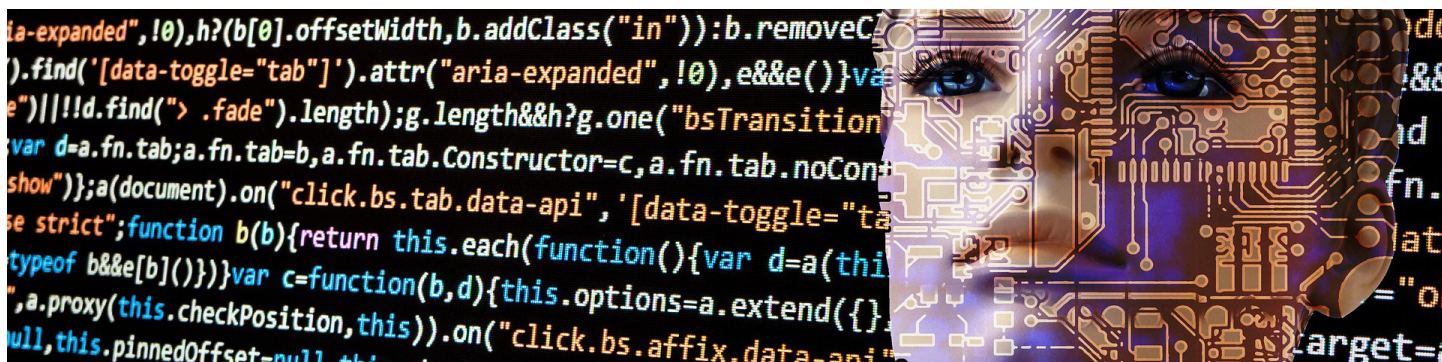
3,137

Advancement Occupation Postings

is \$58,383 for individuals with up to 2 years of experience; \$79,154 for those with 3 to 5 years, and \$95,250 for individuals with 6 or more years. There were 3,137 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from software QA engineer or tester to cyber/Information security engineer/analyst. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for cyber/Information security engineer/analyst are knowledge of Linux, Python, cryptography, project management, and customer service. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of information security, information systems, network security, NIST cybersecurity framework, and information assurance. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of vulnerability analysis, Nessus, threat intelligence and analysis, threat modeling, and cybersecurity assessment.



Software QA Engineer / Tester

Starting Occupation



Cyber / Information Security Engineer / Analyst

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
Linux	19%	Information Security	49%	Vulnerability analysis	5%
Python	14%	Information Systems	27%	Nessus	5%
Cryptography	13%	Network Security	18%	Threat Intelligence and Analysis	5%
Project Management	12%	NIST Cybersecurity Framework	12%	Threat Modeling	5%
Customer Service	11%	Information Assurance	12%	Cybersecurity Assessment	4%

Certifications

The software QA engineer or tester occupation commonly requests security clearance, driver's license, and among others, the following certification: American Society for Quality (ASQ) Certification. ASQ certification is a formal recognition that an individual has demonstrated a proficiency within, and comprehension of, a specific body of knowledge. An ASQ Certified Software Quality Engineer understands software quality development and implementation, software inspection, testing, verification and validation; and implements software development and maintenance processes and methods.

The Cyber / information security engineer / analyst occupation commonly requests security clearance, and among others, the following certifications: Certified Information Systems Security Professional (CISSP), a certification designed to validate information security work experience and a working knowledge of security principles and practices. CISSP is utilized to demonstrate that a security professional is able to design, engineer,

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- American Society For Quality (ASQ) Certification

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Certified Information Systems Security Professional (CISSP)
- SANS/GIAC Certification

implement, and run an information security program. The second top certification is GIAC certifications by the SANS Institute. GIAC provides a set of vendor-neutral computer security certifications.

Software QA Engineer / Tester

Starting Occupation

Database Architect

Advancement Occupation



Advancement Occupation

Database architects design strategies for company-wide large databases, data warehouse systems, and multidimensional networks. They set standards for database operations, programming, query processes, and security. Database architects model, design, and construct large relational databases or data warehouses. Create and optimize data models for warehouse infrastructure and workflow. They also integrate new systems with existing warehouse structure and refine system performance and functionality. These individuals are comfortable structuring complex problems through deductive reasoning, and can communicate their recommendations in simple business-like language. But most of all, they expose significant oral and reading comprehension.

Growth

The similarity score between database architect and the starting occupation is 0.483 and the average salary differential is \$18,399. While the projected 5-year employment growth for software QA engineer or tester is 2.29%, database architect's projected 5-year growth is higher at 2.99%. Average salary for the database architect occupation is \$69,185 for individuals with up to

0.483

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$18,399

Average Salary Differential



2.29%

Projected 5-Year Growth

Projected employment growth for the Starting Occupation



2.99%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Software QA Engineer / Tester

Starting Occupation

\$69,185

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$85,231

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$98,672

Average Salary: Advancement

Occupation with 6+ years experience

2,285

Starting Occupation Postings

870

Advancement Occupation Postings

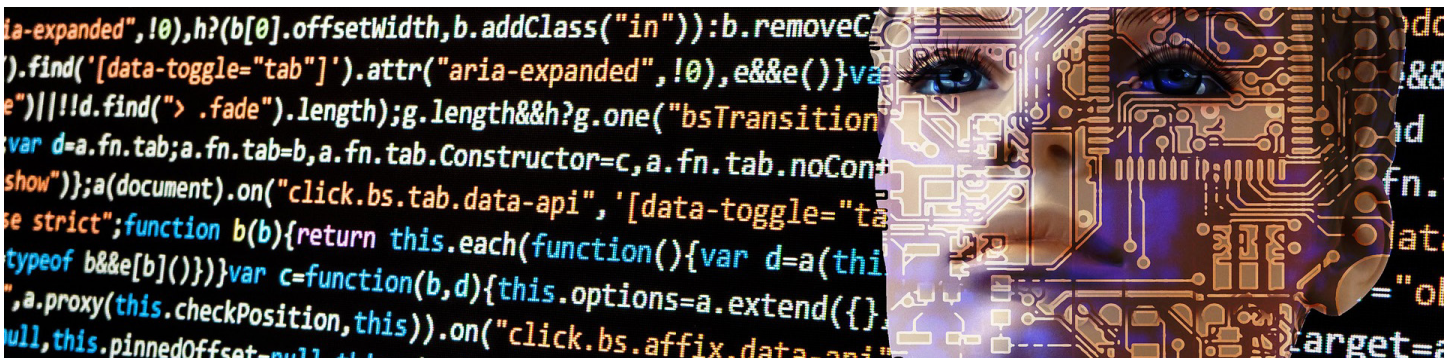
Database Architect

Advancement Occupation

2 years of experience; \$85,231 for those with 3 to 5 years, and \$98,672 for individuals with 6 or more years. There were 870 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from software QA engineer or tester to database architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for database architect are knowledge of data analysis, Oracle, data quality, project management, and SQL server. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of SQL, data architecture, data warehousing, data modeling, and Extraction, Transformation and Loading (ETL). Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of ERwin, database architecture, Teradata, Master Data Management (MDM), and virtualization.



Software QA Engineer / Tester

Starting Occupation



Database Architect

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Data Analysis	19%
Oracle	18%
Data Quality	16%
Project Management	12%
SQL Server	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
SQL	43%
Data Architecture	33%
Data Warehousing	26%
Data Modeling	23%
Extraction Transformation and Loading (ETL)	23%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
ERwin	6%
Database Architecture	6%
Teradata	6%
Master Data Management (MDM)	5%
Virtualization	5%

Certifications

The software QA engineer or tester occupation commonly requests security clearance, driver's license, and among others, the following certification: American Society for Quality (ASQ) Certification. ASQ certification is a formal recognition that an individual has demonstrated a proficiency within, and comprehension of, a specific body of knowledge. An ASQ Certified Software Quality Engineer understands software quality development and implementation, software inspection, testing, verification and validation; and implements software development and maintenance processes and methods.

The database architect occupation commonly requests security clearance, and among others, the following top certifications: IT Infrastructure Library (ITIL) Certification. This is an entry-level certification for IT service management. The second is the Certified Scrum Trainer (CST), a certification offered by the Scrum Alliance that enables people to teach CSM (Certified Scrum Master) and CSPO (Certified Scrum Product Owner) courses.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- American Society For Quality (ASQ) Certification

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- IT Infrastructure Library (ITIL) Certification
- Certified Scrum Trainer (CST)

Software QA Engineer / Tester

Starting Occupation

Network Engineer / Architect

Advancement Occupation



Advancement Occupation

Network engineers / architects take care of communication networks, such as local area networks (LANs), wide area networks (WANs), and intranets. They design and implement network configurations, troubleshoot performance issues, carry out network monitoring and configure security systems such as firewalls. Among the major skills that these individuals should possess include analytical, problem-solving and communication skills. They should be team-building, detail-oriented leaders with extensive knowledge of various types of computer operating, security and wireless systems.

Growth

The similarity score between network engineer or architect and the starting occupation is 0.491 and the average salary differential is \$19,813. While the projected 5-year employment growth for software QA engineer or tester is 2.29%, network engineer or architect's projected 5-year growth is slightly higher at 2.86%. Average salary for the network engineer or architect occupation is \$58,383 for individuals with up to 2 years of experience; \$79,154 for those with 3 to 5 years, and \$95,250 for individuals with 6 or

0.491

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$19,813

Average Salary Differential



2.29%

Projected 5-Year Growth

Projected employment growth for the Starting Occupation



2.86%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Software QA Engineer / Tester

Starting Occupation

Network Engineer / Architect

Advancement Occupation

\$58,383

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$79,154

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$95,250

Average Salary: Advancement

Occupation with 6+ years experience

2,285

Starting Occupation Postings

2,525

Advancement Occupation Postings

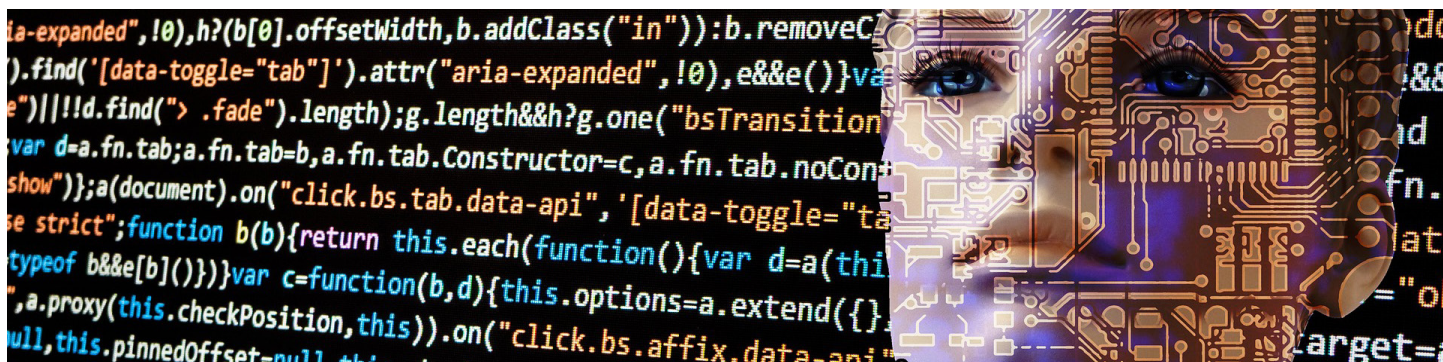
more years. There were 2,525 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from software QA engineer or tester to network engineer or architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for network engineer or architect are knowledge of Python, routers, project management, Java, and software development. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of network engineering, Cisco, Linux, Wide Area Network (WAN), and VMware. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Microsoft active directory, Voice over IP (VoIP), network testing, network hardware, and Citrix.

Certifications

The software QA engineer or tester occupation commonly requests security clearance, driver's license, and among



Software QA Engineer / Tester

Starting Occupation



Network Engineer / Architect

Advancement Occupation

Necessary Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Python	17%
Routers	14%
Project Management	13%
Java	12%
Software Development	12%

Defining Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Network Engineering	28%
Cisco	24%
Linux	16%
Wide Area Network (WAN)	14%
VMware	11%

Distinguishing Skills

Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft Active Directory	7%
Voice over IP (VoIP)	5%
Network Testing	4%
Network Hardware	4%
Citrix	3%

others, the following certification: American Society for Quality (ASQ) Certification. ASQ certification is a formal recognition that an individual has demonstrated a proficiency within, and comprehension of, a specific body of knowledge. An ASQ Certified Software Quality Engineer understands software quality development and implementation, software inspection, testing, verification and validation; and implements software development and maintenance processes and methods.

The network engineer/ architect occupation commonly requests security clearance, and, among others, the following certifications: Cisco Certified Network Associate (CCNA), an associate-level Cisco Career certification. The second top certification is Cisco Certified Network Professional (CCNP), a certification for individuals in the IT industry who have achieved the professional level of Cisco Career Certification. Both certifications are from Cisco Systems.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- American Society For Quality (ASQ) Certification

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Cisco Certified Network Associate (CCNA)
- Cisco Certified Network Professional (CCNP)

Software QA Engineer / Tester

Starting Occupation

Web Developer

Advancement Occupation



Advancement Occupation

Web developers create and maintain websites. They are also responsible for the site's technical aspects, such as its performance and capacity, which are measures of a website's speed and how much traffic the site can handle. In addition, web developers may create content for the site. They evaluate code to ensure that it is properly structured, meets industry standards, and is compatible with browsers and devices. These developers optimize website performance, scalability, and server-side code and processes. They may develop website infrastructure and integrate websites with other computer applications. These individuals are comfortable working with technology as the core of their responsibilities, but over time, must develop a good understanding of consumer behavior, as well as collaboration skills and project management.

Growth

The similarity score between web developer and the starting occupation is 0.552 and the average salary differential is \$16,815. While the projected 5-year employment growth for software QA engineer or tester is 2.29%, web developer's projected 5-year growth is slightly lower at 2.18%. Average salary for the web developer

0.552

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$16,815

Average Salary Differential



2.29%

Projected 5-Year Growth

Projected employment growth for the Starting Occupation



2.18%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Software QA Engineer / Tester

Starting Occupation

Web Developer

Advancement Occupation

\$70,021

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$86,093

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$98,621

Average Salary: Advancement

Occupation with 6+ years experience

2,285

Starting Occupation Postings

2,947

Advancement Occupation Postings

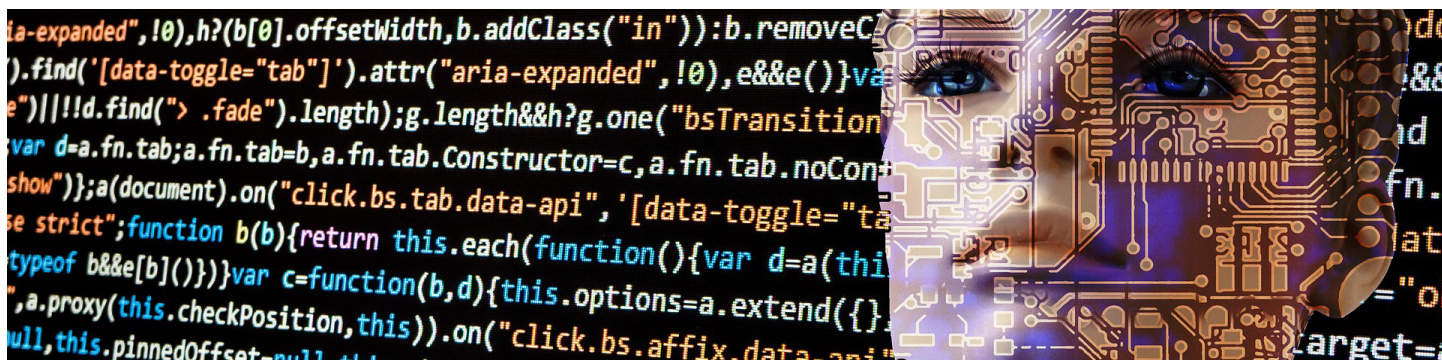
occupation is \$70,021 for individuals with up to 2 years of experience; \$86,093 for those with 3 to 5 years, and \$98,621 for individuals with 6 or more years. There were 2,947 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from software QA engineer or tester to web developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for web developer are knowledge of Microsoft C#, Python, MySQL, Ruby, and unit testing. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of JavaScript, web development, front-end development, Java, and SQL. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Flask, Joomla, AJAX, User Interface (UI) Design, and Objective C.

Certifications

The software QA engineer or tester occupation commonly requests security



Software QA Engineer / Tester

Starting Occupation



Web Developer

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft C#	18%	JavaScript	59%	Flask	7%
Python	17%	Web Development	39%	Joomla	6%
MySQL	16%	Front-end Development	32%	AJAX	6%
Ruby	16%	Java	28%	User Interface (UI) Design	6%
Unit Testing	16%	SQL	28%	Objective C	6%

clearance, driver's license, and among others, the following certification: American Society for Quality (ASQ) Certification. ASQ certification is a formal recognition that an individual has demonstrated a proficiency within, and comprehension of, a specific body of knowledge. An ASQ Certified Software Quality Engineer understands software quality development and implementation, software inspection, testing, verification and validation; and implements software development and maintenance processes and methods.

The web developer occupation commonly requests security clearance, driver's license and the following certification: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- American Society For Quality (ASQ) Certification

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- CompTIA Security+

Software QA Engineer / Tester

Starting Occupation

Computer Systems Engineer / Architect

Advancement Occupation



Advancement Occupation

Computer systems engineers or architects design and develop solutions to complex applications problems, system administration issues, or network concerns. They perform systems management and integration functions. These individuals develop software engineering, system integration, or distributed system architectures. They also collaborate with software developers to select appropriate design solutions and to ensure the compatibility of system components. These individuals are comfortable with paying attention to detail, using analytical skills and working in an atmosphere of innovation.

Growth

The similarity score between computer systems engineer or architect and the starting occupation is 0.547 and the average salary differential is \$23,493. While the projected 5-year employment growth for software QA engineer or tester is 2.29%, computer systems engineer or architect's projected 5-year growth is slightly higher at 2.75%. Average salary for the computer systems engineer or architect occupation is \$60,813 for individuals with up to 2 years of experience; \$83,001 for those with 3 to 5 years, and \$99,718 for

0.547

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$23,493

Average Salary Differential



2.29%

Projected 5-Year Growth

Projected employment growth for the Starting Occupation



2.75%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Software QA Engineer / Tester

Starting Occupation

\$60,813

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$83,001

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$99,718

Average Salary: Advancement

Occupation with 6+ years experience

2,285

Starting Occupation Postings

3,259

Advancement Occupation Postings

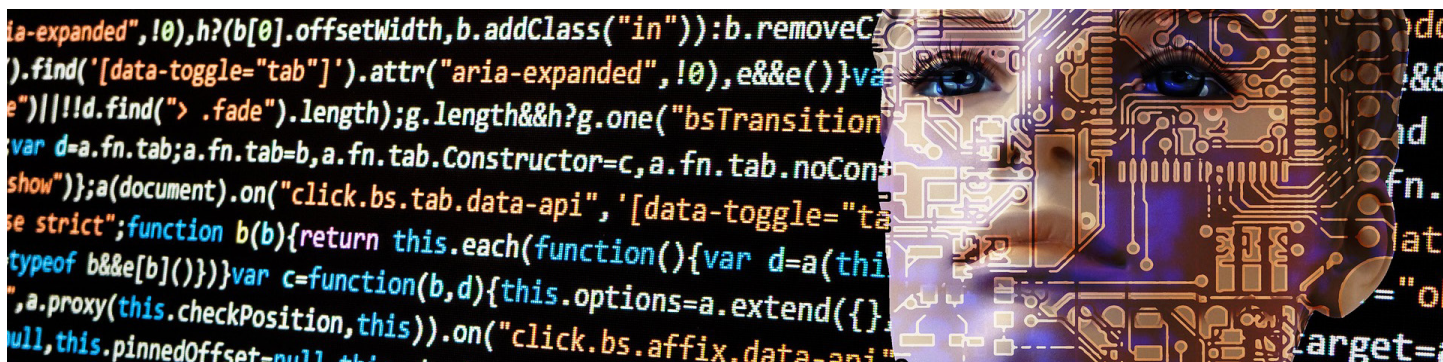
Computer Systems Engineer / Architect

Advancement Occupation

individuals with 6 or more years. There were 3,259 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from software QA engineer or tester to computer systems engineer or architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for computer systems engineer or architect are knowledge of Python, software development, SQL, project management, and software engineering. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of systems engineering, Linux, Java, DevOps, and system architecture. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of UNIX, Windows server, Continuous Integration (CI), firmware, and hardware and software configuration.



Software QA Engineer / Tester

Starting Occupation



Computer Systems Engineer / Architect

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
Python	19%	Systems Engineering	46%	UNIX	8%
Software Development	17%	Linux	20%	Windows Server	6%
SQL	14%	Java	17%	Continuous Integration (CI)	5%
Project Management	11%	DevOps	12%	Firmware	4%
Software Engineering	11%	System Architecture	12%	Hardware and Software Configuration	4%

Certifications

The software QA engineer or tester occupation commonly requests security clearance, driver's license, and among others, the following certification: American Society for Quality (ASQ) Certification. ASQ certification is a formal recognition that an individual has demonstrated a proficiency within, and comprehension of, a specific body of knowledge. An ASQ Certified Software Quality Engineer understands software quality development and implementation, software inspection, testing, verification and validation; and implements software development and maintenance processes and methods.

The computer systems engineer or architect occupation commonly requests security clearance and among others, the following top certifications: CompTIA Security+, a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career; and Certified Information Systems Security Professional (CISSP), a certification designed to validate information security

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- American Society For Quality (ASQ) Certification

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- CompTIA Security+
- Certified Information Systems Security Professional (CISSP)

work experience and a working knowledge of security principles and practices. CISSP is utilized to demonstrate that a security professional is able to design, engineer, implement, and run an information security program.

Software QA Engineer / Tester

Starting Occupation

Mobile Applications Developer

Advancement Occupation

Advancement Occupation

A mobile applications developer is a software engineer who works primarily with mobile devices, creating, programming, testing, and maintaining apps and mobile platforms across devices like smartphones, tablets and laptops. Mobile developers write programs inside of a mobile development environment using a specific programming language such as Objective C or Java. A mobile app developer will typically develop an app for a specific operating system, such as Google Android or Apple iOS, and apply the programming languages and software development environment for that platform. These individuals are usually curious, imaginative, and value variety. They are methodical, reliable and generally plan things in advance. These individuals are comfortable with the fast pace of change in the underlying development technologies.

Growth

The similarity score between mobile applications developer and the starting occupation is 0.575 and the average salary differential is \$25,396. While the projected 5-year employment growth for software QA engineer or tester is 2.29%, mobile applications developer's projected 5-year growth is higher at 5.63%.

0.575

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$25,396

Average Salary Differential



2.29%

Projected 5-Year Growth

Projected employment growth for the Starting Occupation



5.63%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Software QA Engineer / Tester

Starting Occupation

Mobile Applications Developer

Advancement Occupation

\$70,826

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$89,272

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$102,130

Average Salary: Advancement

Occupation with 6+ years experience

2,285

Starting Occupation Postings

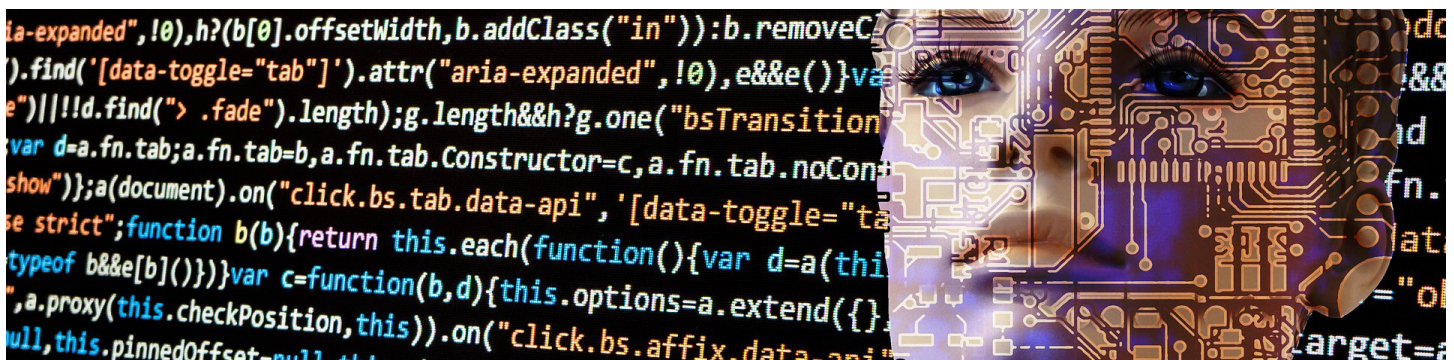
558

Advancement Occupation Postings

Average salary for the mobile applications developer occupation is \$70,826 for individuals with up to 2 years of experience; \$89,272 for those with 3 to 5 years, and \$102,130 for individuals with 6 or more years. There were 558 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from software QA engineer or tester to mobile applications developer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for mobile applications developer are knowledge of unit testing, Object-Oriented Analysis and Design (OOAD), JavaScript Object Notation (JSON), debugging, and Scrum. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Java, Swift (programming language), Android, Software development, and Objective C. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Test Driven Development (TDD), User Interface (UI) Design, Gradle, React Javascript, and Microsoft Xamarin.



Software QA Engineer / Tester

Starting Occupation



Mobile Applications Developer

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
Unit Testing	17%	Java	43%	Test Driven Development (TDD)	7%
Object-Oriented Analysis and Design (OOAD)	14%	Swift (Programming Language)	38%	User Interface (UI) Design	7%
JavaScript Object Notation (JSON)	14%	Android	36%	Gradle	6%
Debugging	14%	Software Development	31%	React Javascript	6%
Scrum	12%	Objective C	29%	Microsoft Xamarin	6%

Certifications

The software QA engineer or tester occupation commonly requests security clearance, driver's license, and among others, the following certification: American Society for Quality (ASQ) Certification. ASQ certification is a formal recognition that an individual has demonstrated a proficiency within, and comprehension of, a specific body of knowledge. An ASQ Certified Software Quality Engineer understands software quality development and implementation, software inspection, testing, verification and validation; and implements software development and maintenance processes and methods.

The mobile applications developer occupation commonly requests security clearance, driver's license and the following certification: TOGAF certification. The Open Group Architecture Framework (TOGAF) is a certification for IT professionals and architects that verifies their ability to simplify complex technical processes in four architecture domains: business, data, applications and technical.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- American Society For Quality (ASQ) Certification

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- TOGAF Certification

Software QA Engineer / Tester

Starting Occupation

Business Intelligence Architect / Developer

Advancement Occupation



Advancement Occupation

Business intelligence architects or developers are responsible for designing and developing BI solutions, overseeing the implementation of these types of systems and also their ongoing maintenance. They are in charge of developing, deploying, and maintaining BI interfaces. Those include query tools, data visualization and interactive dashboards, ad hoc reporting, and data modeling tools. These individuals are comfortable working with large amounts of data and deriving insights from their analysis. Some individuals may be more comfortable presenting and communicating results to others. But in either case, they are good at examining multiple sources of data and then making accurate conclusions about them. These individuals are naturally inquisitive and over time, develop a great deal of forward-thinking vision.

Growth

The similarity score between business intelligence architect or developer and the starting occupation is 0.524 and the average salary differential is \$23,710. While the projected 5-year employment growth for software QA engineer or tester is 2.29%, business intelligence architect or developer's projected 5-year growth is higher at 6.30%. Average salary for the business intelli-

0.524

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$23,710

Average Salary Differential



2.29%

Projected 5-Year Growth

Projected employment growth for the Starting Occupation



6.30%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Software QA Engineer / Tester

Starting Occupation

\$70,639

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$87,647

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$101,639

Average Salary: Advancement

Occupation with 6+ years experience

2,285

Starting Occupation Postings

855

Advancement Occupation Postings

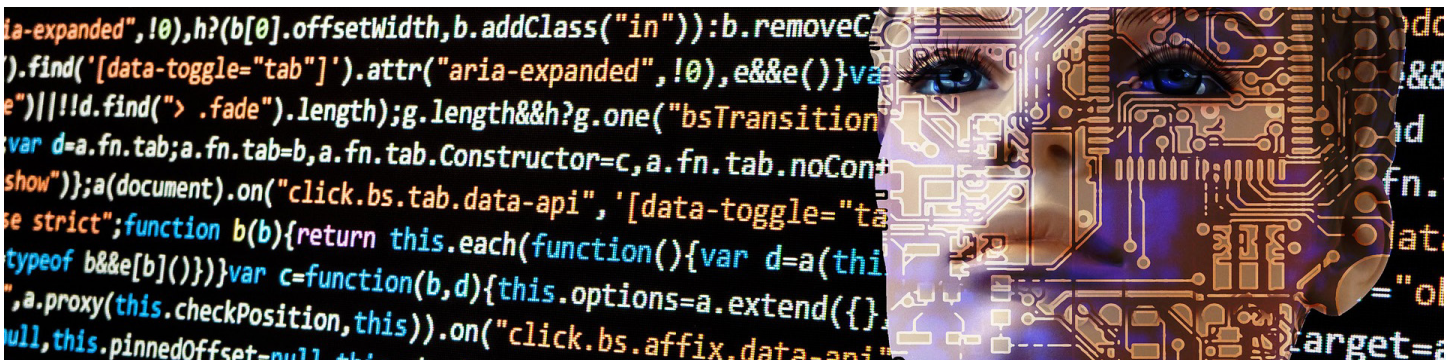
Business Intelligence Architect / Developer

Advancement Occupation

gence architect or developer occupation is \$70,639 for individuals with up to 2 years of experience; \$87,647 for those with 3 to 5 years, and \$101,639 for individuals with 6 or more years. There were 855 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from systems analyst to network engineer or architect. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for business intelligence architect or developer are knowledge of JavaScript, software development, business process, Oracle, and Microsoft Power BI. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Salesforce, Salesforce development, SQL, Salesforce Visualforce, and Salesforce Lightning. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation, the distinguishing skills are knowledge of Microsoft SQL Server Integration Services (SSIS), SQL Server Reporting Services (SSRS), Informatica, data architecture, and Oracle PL/SQL.



Software QA Engineer / Tester

Starting Occupation



Business Intelligence Architect / Developer

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
JavaScript	18%	Salesforce	49%	Microsoft Sql Server Integration Services (SSIS)	5%
Software Development	15%	Salesforce Development	39%	SQL Server Reporting Services (SSRS)	5%
Business Process	15%	SQL	34%	Informatica	5%
Oracle	13%	Salesforce Visualforce	24%	Data Architecture	5%
Microsoft Power BI	12%	Salesforce Lightning	19%	Oracle PL/SQL	4%

Certifications

The software QA engineer or tester occupation commonly requests security clearance, driver's license, and among others, the following certification: American Society for Quality (ASQ) Certification. ASQ certification is a formal recognition that an individual has demonstrated a proficiency within, and comprehension of, a specific body of knowledge. An ASQ Certified Software Quality Engineer understands software quality development and implementation, software inspection, testing, verification and validation; and implements software development and maintenance processes and methods.

The business intelligence architect or developer occupation commonly requests security clearance, and among others, the following certifications: Certified Salesforce Platform Developer. With this credential, individuals use programmatic and declarative skills to extend and customize Salesforce applications. The second is the Certified Salesforce Administrator. This certification focuses on the features and functionality used to maintain a Salesforce implementation.

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- American Society For Quality (ASQ) Certification

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- Certified Salesforce Platform Developer
- Certified Salesforce Administrator

Software QA Engineer / Tester

Starting Occupation



Software Developer/ Engineer

Advancement Occupation

Advancement Occupation

Software developers/ engineers design, and build computer programs. They identify user needs, develop the programs, test out new software, and make improvements. Some develop new applications for mobile or desktop use, while others build underlying systems software such as operating systems. They design each piece of an application or system and plan how the pieces will work together. Software developers / engineers create a variety of models and diagrams showing programmers the software code needed for an application. Working closely with computer programmers, software developers fill crucial roles not only in the computer systems industry, but also in manufacturing, finance, health services and software publishing industries. These individuals are comfortable with the uncertainties surrounding innovation and creativity. They have an ability to focus and concentrate for prolonged time periods addressing numerous and interlocking pieces. Finally, software developers / engineers are problem solvers, as they are responsible for solving the problems that occur during the development process.

Growth

The similarity score between software developer or engineer and the starting occupation is 0.648 and the average salary

0.648

Similarity Score

Measure of relatedness between occupations on a scale of 0 to 1



\$19,022

Average Salary Differential



2.29%

Projected 5-Year Growth

Projected employment growth for the Starting Occupation



5.84%

Projected 5-Year Growth

Projected employment growth for the Advancement Occupation



Software QA Engineer / Tester

Starting Occupation

Software Developer/ Engineer

Advancement Occupation

\$68,768

Average Salary: Advancement

Occupation with 0 - 2 years experience

\$84,801

Average Salary: Advancement

Occupation with 3 - 5 years experience

\$98,508

Average Salary: Advancement

Occupation with 6+ years experience

2,285

Starting Occupation Postings

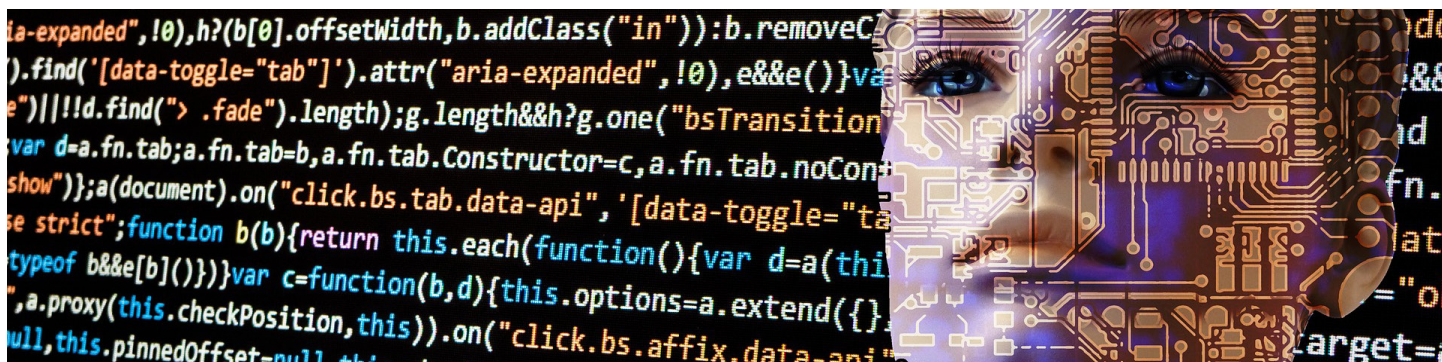
16,139

Advancement Occupation Postings

differential is \$19,022. While the projected 5-year employment growth for software QA engineer or tester is 2.29%, software developer or engineer's projected 5-year growth is higher at 5.84%. Average salary for the software developer or engineer occupation is \$68,768 for individuals with up to 2 years of experience; \$84,801 for those with 3 to 5 years, and \$98,508 for individuals with 6 or more years. There were 16,139 postings for the advancement occupation.

Skills

The skills in the following table represent the additional skills likely needed to move from software QA engineer or tester to software developer or engineer. The skill taxonomy used in this analysis classifies skills for a given occupation as necessary, defining or distinguishing. Necessary skills are specialized skills required for this job and relevant across other similar jobs. The necessary skills for software developer or engineer are knowledge of Microsoft C#, Linux, .NET, Oracle, and C++. Defining skills represent the day-to-day tasks and responsibilities of the job. For this occupation the defining skills include knowledge of Java, software engineering, software development, SQL, and JavaScript. Distinguishing skills set a worker apart and come with a salary or growth premium. For this occupation,



Software QA Engineer / Tester

Starting Occupation



Software Developer/ Engineer

Advancement Occupation

Necessary Skills		Defining Skills		Distinguishing Skills	
Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation	Skill Gap	Skill Recall Percentage in Advancement Occupation
Microsoft C#	16%	Java	40%	JavaScript Object Notation (JSON)	7%
Linux	15%	Software Engineering	34%	jQuery	6%
.NET	13%	Software Development	33%	React Javascript	6%
Oracle	12%	SQL	32%	Spring Boot	6%
C++	12%	JavaScript	26%	Ruby	5%

the distinguishing skills are knowledge of JavaScript Object Notation (JSON), jQuery, React Javascript, Spring Boot, and Ruby.

Certifications

The software QA engineer or tester occupation commonly requests security clearance, driver's license, and among others, the following certification: American Society for Quality (ASQ) Certification. ASQ certification is a formal recognition that an individual has demonstrated a proficiency within, and comprehension of, a specific body of knowledge. An ASQ Certified Software Quality Engineer understands software quality development and implementation, software inspection, testing, verification and validation; and implements software development and maintenance processes and methods.

The software developer/ engineer occupation commonly requests security clearance, and among others, the following certifications: IT Infrastructure Library (ITIL) Certification. Entry-level certification for IT service management. The second certification is CompTIA Security+,

Certifications

The source occupation commonly requests the following certifications:

- Security Clearance
- Driver's License
- American Society For Quality (ASQ) Certification

The Advancement occupation commonly requests the following certifications:

- Security Clearance
- CompTIA Security+
- IT Infrastructure Library (ITIL) Certification

a globally trusted, vendor-neutral certification that validates the baseline skills necessary to perform core security functions and pursue an IT security career.

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