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INSIDER EXCLUSIVE

GUIDE TO **BIG DATA CERTIFICATIONS**

Demand for big data pros has created the most job openings, the top salaries and the highest job satisfaction ratings of any tech category — **making big data certifications worth your investment.** **BY NEAL WEINBERG**

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THE **BIG DATA JOB CATEGORY**, which includes data scientists, data architects and data engineers, has the most job openings, the top salary and the highest job satisfaction ratings. The key to snagging a big data job is obtaining certifications that prove you have the necessary skills. Check out our guide to [30 top big data certs](#).

Whether you're a veteran IT manager looking to jumpstart your career, a young IT pro who wants to advance to the next great opportunity or an executive on the business side who wants to help the company optimize its business intelligence (BI) capabilities, all roads lead to big data.

**Editor's
NOTE**

By every measure, big data is the fastest growing area within IT. The big data job category has the most job openings, the top salary and the highest job satisfaction ratings. Specific job titles within the broad big data category include data scientist, data architect and data engineer.

Companies are turning to big data analytics to draw actionable business intelligence out of the vast trove of data that enterprises have historically collected and continue to collect on a daily basis. Big data analytics is applicable in virtually every industry, from a manufacturer using IoT sensor data to predict when a specific motor on the plant floor is about to fail, to a healthcare organization aggregating information on tens of thousands of patients to spot patterns and identify effective treatment plans.



The **Big Data** job category has the **most job openings**, the **top salary** and the **highest job satisfaction** ratings.

And if you're in IT and taking the long view in terms of your career path, the big data explosion shows no signs of slowing down, driven by the proliferation of IoT sensors in both enterprise and consumer settings. Anytime you hear the word "smart" in reference to a city, a home, a factory, a hospital and so on you're really talking about big data. Gartner predicts that there will be 20 billion IoT devices deployed by 2020.

On the other hand, two powerful trends within IT – cloud computing and automation – are making other IT jobs increasingly obsolete. If you're a server admin in a company moving its application portfolio to the cloud, or a help desk expert in a company installing automated chat bots, you might want to think about transitioning into big data.

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NAVIGATING THE ROAD TO BIG DATA CERTIFICATIONS



The key to snagging a big data job is obtaining a big data-related certification to demonstrate that you have the requisite skills.

ACCORDING TO A RECENT SURVEY of 730 certified professionals conducted by Certification Magazine, 52 percent of survey respondents said they got a raise within a year of completing a big data certification and 64 percent said the raise was 4 percent or more. In addition, 75 percent of respondents said they received bonuses related to big data certifications. And certifications aren't a one-and-done thing. Nearly 40 percent of respondents said they had two or more active big data certifications.

So, where to start when it comes to certifications? It can seem overwhelming and confusing when you enter the world of Hadoop, MongoDB, Spark, Couchbase, HDFS, MapReduce, Flume, Oozie, Hive, Pig, HBase, YARN, R, SAS, SPSS, Matlab, Stata, Tableau, Qlikview and so on.

But you need to think strategically when it comes to big data certifications. If you intend to stay at your employer, you need to understand the current big data

ecosystem at your company. Find out what databases and toolsets are being used, what the company's cloud strategy is, what skillsets the current team might lack, and what the company's big data roadmap looks like. If you're more interested



in taking the leap to a new job, your best bet is to identify the most popular and in-demand skills. Talk to your peers, network.

Many certifications are vendor specific: Cloudera, Hortonworks, Map R, Mongo DB, Microsoft, IBM, EMC, Oracle, SAS, Amazon. Others are offered by industry groups like

the Data Science Council of America and INFORMS. Most vendor-specific certifications are offered directly by the vendor, but there are also a host of online training sites like Intellipat, Coursera, Whizlabs and Simplilearn that have course catalogs of both vendor-specific and academic-based courses and certifications.

On the academic front, there are certifications offered by places like Stanford that can cost up to \$20,000 and require taking graduate-level courses. But it also makes sense to check with your local colleges to see what's available.

Finally, you need to follow the news. Cloudera and Hortonworks, the two leaders in Hadoop-based big data, finalized a merger earlier this year. Both offer popular certifications programs based on their own tools, and it's unclear at this point whether product lines will be merged and how this will affect certifications.

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Here's a list of 30 Big Data Certifications

CATEGORY 1

Vendor Specific Big Data Certifications

Amazon Web Services Certified Big Data – Specialty

Description: The [AWS Certified Big Data – Specialty](#) – Specialty certification validates technical skills and experience in designing and implementing AWS services to derive value from data. It is intended to validate the ability to: implement core AWS big data services according to basic architecture practices, design and maintain big data, and leverage tools to automate data analysis

Company: Amazon Web Services

Price: \$300 registration fee for exam.

How to prepare: Eligible candidates should have the AWS Certified Cloud Practitioner or current Associate-level certification (AWS Certi-

fied Solutions Architect – Associate, AWS Certified Developer – Associate, or AWS Certified SysOps Administrator – Associate). In addition, candidates should have a minimum of five years hands-on experience in a data analytics field, a background in defining and architecting AWS Big Data services, and experience in designing a scalable, cost-effective architecture to process data.

Test details: 170 minutes, multiple choice, multiple answer

Cloudera Certified Associate (CCA) Administrator

Description: The [CCA Administrator](#) credential certifies that an individual has demonstrated the core systems and cluster administrator skills required by organizations deploying Cloudera in the enterprise, including:

- An understanding of the installation process for Cloudera Manager, Cloudera Hadoop (CDH), and the ecosystem projects.

- The ability to perform basic and advanced configuration needed to effectively administer a Hadoop cluster.
- The ability to maintain and modify the cluster to support day-to-day operations in the enterprise.
- An understanding of how to enable relevant services and configure the cluster to meet goals defined by security policy, as well as knowledge of basic security practices.
- The ability to benchmark the cluster operational metrics, and test system configuration for operation and efficiency.
- The ability to troubleshoot, including finding the root cause of a problem, optimize inefficient execution, and resolve resource contention scenarios.

The credential requires passing the remote-proctored CCA Administra-



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tor Exam (CCA131), which consists of eight to 12 performance-based, hands-on tasks on a pre-configured Cloudera Enterprise cluster. Each question requires the candidate to solve a particular scenario. Some require making configuration and service changes via Cloudera Manager, while others demand knowledge of command line Hadoop utilities and basic competence with the Linux environment. Candidates have 120 minutes to complete the exam.

Company: Cloudera

Price: \$295

How to prepare: There are no prerequisites, but Cloudera says the exam follows the same objectives as the [Cloudera Administrator Training](#), making it excellent preparation for the exam.

Cloudera Certified Associate (CCA) Data Analyst

Description: A SQL developer who earns the [CCA Data Analyst](#) certification demonstrates core analyst skills to load, transform and model Hadoop data to define relationships and extract meaningful results from the raw output. It requires passing the CCA Data Analyst Exam (CCA159), a remote-proctored set of eight to 12 performance-based, hands-on tasks on a CDH 5 cluster. Candidates have 120 minutes to implement a technical solution for each task. They must analyze the problem and arrive at an optimal approach in the time allowed.

Company: Cloudera

Price: \$295

How to prepare: Cloudera recom-

mends candidates take the [Cloudera Data Analyst Training course](#), which has the same objectives as the exam.

Cloudera Certified Associate (CCA) Spark and Hadoop Developer

Description: The [CCA Spark and Hadoop Developer](#) credential certifies a professional has proven their core skills to ingest, transform and process data using Apache Spark and core Cloudera enterprise tools. It requires passing the remote-proctored CCA Spark and Hadoop Developer Exam (CCA175), which consists of eight to 12 performance-based, hands-on tasks on a Cloudera Enterprise cluster. Each question requires the candidate to solve a particular scenario. Some cases may require a tool such as Impala or Hive, others may require coding. Candidates have 120 minutes to complete the exam.

Company: Cloudera

Price: \$295

How to prepare: There are no prerequisites, but Cloudera says the exam follows the same objectives as the [Cloudera Developer Training for Spark and Hadoop course](#), making it excellent preparation for the exam.

Cloudera Certified Professional (CCP): Data Engineer

Description: The [CCP: Data Engineer](#) credential certifies the ability to perform core competencies required to ingest, transform, store and analyze data in Cloudera's CDH environment. It requires passing the remote-proctored CCP: Data Engineer Exam (DE575), a hands-on, practical exam in which each user is given five to eight customer problems each with a unique, large data set, a CDH cluster and four hours. For each problem, the candidate must implement a technical solution with a high degree of precision that meets all the requirements.

Company: Cloudera

Price: \$400

How to prepare: Cloudera suggests professionals seeking this certification have hands-on experience in the field and take the [Cloudera Developer Training for Spark and Hadoop course](#).

EMC Proven Professional Data Scientist Associate (EMCDSA)

Description: The [EMCDSA](#) certification demonstrates an individual's ability to participate and contribute as a data science team member on



Data scientist
ranks **No. 1** on Glassdoor's list
of [50 Best Jobs in America](#).

big data projects. It includes deploying the data analytics lifecycle, reframing a business challenge as an analytics challenge, applying analytic techniques and tools to analyze big data and create statistical models, selecting the appropriate data visualizations and more.

Company: Dell EMC

Price: \$600 for video-ILT streaming; \$5,000 for instructor-led

How to prepare: EMC offers a training course, available as either a video or an instructor-led course.

EMC Data Scientist Advance Analytics Specialist (EMCDS)

Description: The [EMCDS](#) certification builds on the entry-level associate certification and covers general knowledge of big data analytics across different industries and technologies. It doesn't specifically focus on one product or industry, so it's a good option if you aren't sure where you want to go with your data career or if you just want a more generalized certification for your resume.

Cost: Streaming: \$3,000; \$5,000 for instructor-led

How to prepare: The exam covers advanced analytical methods, social network analysis, natural language processing, data visualization methods and popular data tools like Hadoop, Pig, Hive and HBase.

Hortonworks: HDP Apache Spark Developer

Description: The [HDP Apache Spark Developer](#) certification is intended to validate an individual's understanding of Spark Core and Spark SQL applications in Scala or Python. The

exam consists of a series of tasks that must be performed successfully on a live cluster.

Company: Hortonworks

Price: \$250 for exam

How to prepare: Hortonworks offers courses on its website with options that include live training, self-paced e-learning or a blended experience.

Hortonworks: HDP Certified Developer Big Data Hadoop

Description: The [HDP Certified Developer Big Data Hadoop](#) certification validates a developer's proficiency in Pig, Hive, Sqoop and Flume. The exam consists of a series of data ingestion, data transformation and data analysis tasks that must be performed on an HDP 2.4 cluster.

Company: Hortonworks

Price: \$250 for exam

How to prepare: Hortonworks offers courses on its website with options that include live training, self-paced e-learning or a blended experience.

Hortonworks Certified Associate (HCA)

Description: The [Hortonworks Certified Associate \(HCA\)](#) certification is a foundational credential that validates that an individual understands the technologies and can recognize the business use cases for Hortonworks Data Platform (HDP) frameworks. Candidates must pass a multiple-choice exam that consists of 40 questions from the following five categories:

- Data access (including Pig, Hive HCatalog, Tez, Storm, HBase,

Spark and Solr)

- Data management (including HDFS and YARN)
- Data governance and workflow (including Falcon, Atlas, Sqoop, Flume, Kafka and Hortonworks DataFlow)
- Operations (including Ambari, CloudBreak, ZooKeeper and Oozie)
- Security (including Ranger and Knox)

Company: Hortonworks

Price: \$100 for exam

How to prepare: Hortonworks offers courses on its website with options that include live training, self-paced e-learning or a blended experience.

IBM Certified Data Architect - Big Data

Description: Designed for data architects, the [IBM Certified Data Architect - Big Data](#) certification requires passing a test that consists of five sections containing a total of 55 multiple-choice questions. It demonstrates a data architect can work closely with customers and solutions architects to translate customers' business requirements into a big data solution.

Company: IBM

Price: \$200

How to prepare: IBM recommends a series of seven multi-day courses on SPSS Modeler to InfoSphere BigInsights to prepare for the test.

IBM Certified Data Engineer - Big Data

Description: The [IBM Certified Data](#)



The **highest paying** enterprise IT position is big data engineer with a midpoint salary of \$155,000.

- SOURCE: ROBERT HALF TECHNOLOGY'S 2019 SALARY GUIDE

Engineer – Big Data certification is intended for big data engineers, who work directly with data architects and hands-on developers to convert an architect's big data vision into reality. Data engineers understand how to apply technologies to solve big data problems and have the ability to build large-scale data processing systems for the enterprise. They develop, maintain, test and evaluate big data solutions within organizations, providing architects with input on needed hardware and software. This certification requires passing a test that consists of five sections containing a total of 53 multiple-choice questions.

Company: IBM

Price: \$200

How to prepare: IBM recommends a series of nine multi-day courses to prepare for the test.

IBM: Applied AI with Deep Learning, IBM Watson IoT Data Science Certificate

Description: To earn IBM's Watson IoT Data Science Certification, you'll need some experience coding, preferably in Python, but they will consider any programming language as a place to start. Math skills, especially with linear algebra, are recommended but the course promises to

cover the topics within the first week. It's aimed at those with more advanced data science skills. Classes are offered through Coursera.

Company: IBM

Cost: \$49 per month for a subscription to Coursera

MapR Certified Data Analyst 1.9

Description: The [MapR Certified Data Analyst](#) credential validates an individual's ability to perform analytics on large datasets using a variety of tools, including Apache Hive, Apache Pig and Apache Drill. The exam tests the ability to perform typical ETL tasks to manipulate data to perform queries. Questions touch on existing SQL queries, including debugging malformed queries from a given code snippet, choosing the correct query functions to produce a desired result, and typical troubleshooting tasks. The exam consists of 50-60 questions in a two-hour proctored session.

Company: MapR Technologies

Price: \$250 for the exam

How to prepare: MapR recommends candidates prepare with four of its courses: Introduction to SQL Analytics with Apache Drill, Apache Drill Performance and Debugging,

Apache Hive Essentials, and Apache Pig Essentials. MapR also offers an [MCDA Study Guide](#).

MapR Certified Hadoop Developer 1.0

Description: The [MapR Certified Hadoop Developer](#) credential validates a developer's ability to design and develop MapReduce programs in Java and use them to solve typical problems with large data sets. The exam focuses on the use of MapReduce to solve typical data analysis problems using the MapReduce API, managing, monitoring, and testing MapReduce programs and workflows. The exam consists of 50-60 questions in a two-hour proctored session.

Company: MapR Technologies

Price: \$250 for the exam

How to prepare: MapR recommends candidates prepare with three of its courses: Build Hadoop MapReduce Applications, Manage and Test Hadoop MapReduce Applications, and Launch Jobs and Advanced Hadoop MapReduce. MapR also offers an [MCHD Study Guide](#).

MapR Certified Spark Developer 2.1

Description: The [MapR Certified Spark v2.1 Developer](#) credential validates a developer's ability to use Spark to work with large datasets to perform analytics on streaming data. It measures the developer's understanding of the Spark API to perform basic machine learning or SQL tasks on given datasets. The exam consists of 50-60 questions in a two-hour proctored session.

Company: MapR Technologies

Price: \$250 for the exam

How to prepare: MapR recommends candidates prepare with three of its courses: Introduction to Apache Spark, Build and Monitor Apache Spark Applications, and Advanced Apache Spark. MapR also offers an MCSD v2 Study Guide.

Database Development; MCSA: SQL 2016 BI Development; MCSA Machine Learning; MCSA: BI Reporting; or MCSA: Data Engineering with Azure. Additionally, Microsoft offers preparation tools for each of the 12 exams that lead to the MCSE: Data Management and Analytics certification.

ment; prepare data for modeling; perform feature engineering, develop models.

MongoDB Certified DBA Associate

Description: The [MongoDB Certified DBA Associate](#) credential is intended to demonstrate that operations professionals understand the concepts and mechanics required to administrate MongoDB. It requires a 90 minute, multiple choice exam.

Company: MongoDB

Price: \$150

How to prepare: There are no prerequisites, but MongoDB suggests candidates complete an in-person training or one of its online courses (M102: MongoDB for DBAs; M202: MongoDB Advanced Deployment Operations). MongoDB also provides the [MongoDB Certification Exam Study Guide](#), available to those who have registered for a certification exam.

MongoDB Certified Developer Associate

Description: The [MongoDB Certified Developer Associate](#) credential is intended for software engineers who want to demonstrate a solid understanding of the fundamentals of designing and building applications using MongoDB. It requires a 90-minute, multiple choice exam.

Company: MongoDB

Price: \$150

How to prepare: There are no prerequisites, but MongoDB suggests candidates complete an in-person training or one of its online courses (M101J: MongoDB for Java Develop-



As more **industries rely** on big data to make decisions, data science has become increasingly important across all industries, not just tech and finance,

- SOURCE: LINKEDIN WORKFORCE REPORT

Microsoft Certified Solutions Expert (MCSE): Data Management and Analytics

Description: The [MCSE: Data Management and Analytics](#) credential demonstrates broad skill sets in SQL administration, building enterprise-scale data solutions, and leveraging business intelligence (BI) data in both on-premises and cloud environments. To earn the certification, candidates must pass one of 12 exams.

Company: Microsoft

Price: \$165 per exam

How to prepare: To pursue this credential, you must first earn one of seven Microsoft Certified Solutions Associate (MSCA) Certifications: MSCA SQL Server 2012/2014; MCSA: SQL 2016 Database Administration; MCSA: SQL 2016

Microsoft Certified Azure Data Scientist Associate

Description: The [Azure Data Scientist Associate](#) certification from Microsoft focuses your ability to utilize machine learning to “train, evaluate and deploy models that solve business problems.” Candidates for the exam are tested on machine learning, AI solutions, natural language processing, computer vision and predictive analytics. The exam focuses on defining and preparing the development environment, data modeling, feature engineering and developing models.

Company: Microsoft

Cost: \$165

How to prepare: This exam measures your ability to accomplish the following technical tasks: define and prepare the development environ-

ers; M101JS: MongoDB for Node.js Developers; M101N: MongoDB for .NET Developers; M101P: MongoDB for Developers). MongoDB also provides the [MongoDB Certification Exam Study Guide](#), available to those who have registered for a certification exam.

Oracle Business Intelligence Foundation Suite 11 Certified Implementation Specialist

Description: The [Oracle Business Intelligence Foundation Suite 11g Certified Implementation Specialist](#) certification demonstrates skills in implementing solutions based on Oracle Business Intelligence Suite. It covers installing Oracle Business Intelligence Enterprise Edition (OBIEE), building the BI Server metadata repository, building BI dashboards, constructing ad hoc queries, defining security settings, and configuring and managing cache files. The certification is intended for intermediate-level implementation team members with up-to-date training and field experience. Earning the certification requires passing the Oracle Business Intelligence (OBI) Foundation Suite 11g Essentials exam (1ZO-591). It's a multiple-choice exam that consists of 75 questions. Candidates have 120 minutes to complete the exam.

Company: Oracle

Price: \$245

How to prepare: Oracle recommends candidates complete one of two training courses: Oracle Business Intelligence Enterprise Edition Plus Implementation Boot Camp (only available to partners), or Oracle Business Intelligence Foundation 11g Implementation Specialist.

SAS Certified Big Data Professional

Description: The [SAS Certified Big Data Professional](#) certification program is for individuals seeking to build on their basic programming knowledge by learning how to gather and analyze big data in SAS. The program focuses on SAS programming skills; accessing, transforming and manipulating data; improving data quality for reporting and analytics; fundamentals of statistics and analytics; working with Hadoop, Hive, Pig and SAS; and exploring and visualizing data. The program includes two certification exams, both of which the participants must pass.

Company: SAS

Price: \$9,000 for classroom (Cary, NC), \$299/month or \$2,250/year for self-paced e-learning.

How to prepare: At least six months of programming experience in SAS or another programming language is required to enroll.

SAS Certified Data Scientist Using SAS 9

Description: The [SAS Certified Data Scientist Using SAS 9](#) credential demonstrates that individuals can manipulate and gain insights from big data with a variety of SAS and open source tools, make business recommendations with complex learning models, and then deploy models at scale using the SAS environment. The certification requires passing five exams that include multiple choice, short answer, and interactive questions (in a simulated SAS environment). The exams include:

- SAS Big Data Preparation, Statistics and Visual Exploration
- SAS Big Data Programming and Loading
- Predictive Modeling Using SAS Enterprise Miner 7, 13, or 14
- SAS Advanced Predictive Modeling
- SAS Text Analytics, Time Series, Experimentation and Optimization

Company: SAS

Price: \$180 for each exam; \$250 for Predictive Modeling Using SAS Enterprise Miner

How to prepare: SAS recommends candidates prepare using its SAS Data Science curriculum from [SAS Academy for Data Science](#). It costs \$4,400 for a self-paced e-Learning course, or \$16,000 for a 12-week instructor-led program in Cary, N.C.

SAS Certified Advanced Analytics Professional

Description: This program covers machine learning, predictive modeling techniques, working with big data sets, finding patterns, optimizing data techniques and time series forecasting. The certification program consists of nine courses and three exams that you'll have to pass to earn the designation.

Company: SAS

Cost: \$299 per month subscription

How to prepare: You'll need at least six months of programming experience in SAS or another language and it's also recommended that you have at least six months of experience using mathematics or statistics in a business setting.

CATEGORY 2

Industry Associations

INFORMS: Certified Analytics Professional

Description: The [Certified Analytics Professional](#) (CAP) credential is a general analytics certification that certifies end-to-end understanding of the analytics process, from framing business and analytic problems to acquiring data, methodology, model building, deployment and model lifecycle management. It requires completion of the CAP exam and adherence to the CAP Code of Ethics.

Organization: INFORMS is the leading international association for Operations Research & Analytics professionals.

Price: \$695 or \$495 if you are an INFORMS member. Team pricing is available.

How to prepare: A list of study courses and a series of webinars are available through registration. The examination is based on the Job Task Analysis (JTA) developed and validated by subject matter experts and practitioners and which serves as the blueprint. For the content of the CAP® program. There are seven

areas of responsibility: business problem framing, analytics problem framing, data, methodology selection, model building, deployment and lifecycle management. There are 100 four-option, multiple-choice questions on the exam.

Data Science Council of America (DASCA): Data Scientist Certifications

Description: The Data Science Council of America offers a data scientist certification that was designed to address “credentialing requirements of senior, accomplished professionals who specialize in managing and leading Big Data strategies and programs for organizations,” according to DASCA. The certification track includes paths for earning your Senior Data Scientist (SDS) and the more advanced Principal Data Scientist (PDS) credentials. Both exams last 100 minutes and consist of 85 and 100 multiple-choice questions for the SDS and PDS exams, respectively.

Cost: \$520 per exam

How to prepare: You’ll need at least six or more years of big data analytics or engineering experience to start on the SDS track and 10 or more years of experience to qualify for the PDS exam.



The U.S. Bureau of Labor Statistics predicts a **12% growth rate** for computer and IT jobs through 2024...

CATEGORY 3

Academic Certifications

Columbia University: Certification of Professional Achievement in Data Sciences

Description: The [Certification of Professional Achievement in Data Sciences](#) is a non-degree program intended to develop facility with foundational data science skills. The program consists of four courses: Algorithms for Data Science, Probability & Statistics, Machine Learning for Data Science, and Exploratory Data Analysis and Visualization.

School: Columbia University

Price: \$2,000 per credit (a minimum of 12 credits, including the four courses). In addition, there is an \$85 non-refundable application fee for the on-campus program and \$150 for the online program. The online program also includes an additional non-refundable technology fee of \$395 per course.

How to prepare: An undergraduate degree and prior quantitative and introductory to computer programming coursework are required.

International School of Engineering: Post Graduate Program (PGP) in Big Data Analytics

Description: Offered in Hyderabad and Bengaluru, India, the [PGP in Big Data Analytics](#) is a 23-weekend program spread over six months that consists of classroom-based

lecture and lab sessions. It focuses on statistics, machine learning, text analysis, AI and decision sciences, and big data.

It consists of 10 courses (lectures and labs) covering all aspects of analytics, including R and Hadoop skills, statistical modeling, data analytics, machine learning, text mining and optimization. Students are evaluated on a real-world capstone project and a series of tests and mini-projects.

its entrance exam and prior academic background and work experience.

Stanford University: Data Mining and Applications Graduate Certificate

Description: The [Data Mining and Applications Graduate Certificate](#) certifies the ability to use statistical methods to extract meaning from large datasets, develop and use predictive models and analytics, and understand and use strategic



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Nationally, there is a **shortage** of more than **150,000** people with data science skills.

- SOURCE: LINKEDIN WORKFORCE REPORT

School: International School of Engineering (INSOFE)

Price: \$43.21 (3,000 Rupees) application fee and a program fee of \$5,041 (350,000 Rupees) plus an 18 percent service tax.

How to prepare: INSOFE admits students based on performance on

decision-making applications. Geared at strategy managers, scientific researchers, social sciences researchers, data analysts and consultants, and advertising and marketing executives, the certificate requires candidates complete three courses, starting with either Data Mining and Analysis or Introduc-

tion to Statistical Learning. The first course must be completed with a B+ or better and the other courses must be completed with a B or better to earn the certificate award. It takes an average of one to two years to complete the certificate.

School: Stanford Center for Professional Development.

Price: \$11,340 - \$12,600 (9-10 units)

How to prepare: To pursue the graduate certificate, candidates must have taken introductory courses in statistics or probability, linear algebra, and computer programming. The candidate also requires a conferred Bachelor's Degree with an undergraduate GPA of 3.5 or better.

Stanford University: Mining Massive Data Sets Graduate Certificate

Description: Designed for software engineers, statisticians, predictive modelers, market researchers, analytics professionals, and data miners, the [Mining Massive Data Sets Graduate Certificate](#) requires four courses and demonstrates mastery of efficient, powerful techniques and algorithms for extracting information from large datasets like the Web, social network graphs and large document repositories. The certificate usually takes one to two years to complete.

School: Stanford Center for Professional Development

Price: \$18,900 tuition

How to prepare: A Bachelor's Degree with an undergraduate GPA of 3.0 or better is required. Applicants should have knowledge of basic computer science principles and skills, at a

level sufficient to write a reasonably non-trivial computer program.

University of Delaware: Analytics: Optimizing Big Data Certificate

Description: The [Analytics: Optimizing Big Data Certificate](#) is an undergraduate-level program intended for business, marketing and operations managers, data analysts and professionals, financial industry professionals, and small business owners. The program brings together statistics, analysis, and written and oral communications skills. It introduces students to the tools needed to analyze large datasets, covering topics including importing data into an analytics software package, exploratory graphical and data analysis, building analytics models, finding the best model to explore correlation among variables and more.

This program introduces students to the tools needed to analyze large datasets in order to make more informed business decisions. Students learn to gather and organize data for more effective analysis and how to communicate their analyses in a clear and concise manner. To earn the Analytics Certificate, all of the following modules must be successfully completed with a grade of "C" or above: Analytics Basics, Big Data Tools, Process Control and Capability, and Individual Project

School: University of Delaware

Price: \$2,895 course fee

How to prepare: A basic background in statistics and some prior college coursework is recommended. ♦