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Big data adds up to opportunities in math careers

By Michael Rieley

If you're looking for an in-demand career, you might want to consider the field of mathematical science. Employment of mathematical science occupations is projected to grow 27.9 percent from 2016 to 2026, much faster than the average for all occupations, resulting in about 50,400 new jobs. Although this small group includes only four detailed occupations, 3 of the 4 are among the top 30 fastest growing occupations to 2026. This **Beyond the Numbers** article takes a detailed look at these four occupations and explores the main reason for this projected growth: business and government use of "big data," which individuals in mathematical science occupations are particularly trained to process and analyze.

What is big data?

Big data refers to the large amount of information available because of recent advances in technology. For example, smart phones, tablets, and Internet-connected home appliances all track and store information on purchasing and item usage. This information can provide insight into individual and consumer behavior, but we need people who can make sense of the large volume of data. Workers who have the analytical skills needed to draw conclusions from the raw data will benefit. Table 1 provides historical and projected employment data for mathematical science occupations, one of the key sources of workers with these skills.

Table 1: Employment change for mathematical science occupations, projected 2016–26 (numbers in thousands)

Occupational title	SOC code[1]	Employment		Change, 2016–26	
		2016	2026	Number	Percent
Total, all occupations	00-0000	156,063.8	167,582.3	11,518.6	7.4
Mathematical science occupations	15-2000	180.7	231.0	50.4	27.9
Actuaries	15-2011	23.6	28.9	5.3	22.5
Mathematicians	15-2021	3.1	4.0	0.9	29.7
Operations research analysts	15-2031	114.0	145.3	31.3	27.4
Statisticians	15-2041	37.2	49.8	12.6	33.8

[1]The 2010 Standard Occupational Classification (SOC) system is a federal statistical standard used by federal agencies to classify workers into occupational categories for the purpose of collecting, calculating, or disseminating data.

Source: U.S. Bureau of Labor Statistics, Employment Projections program, https://www.bls.gov/emp/.

Employment outlook by detailed mathematical occupation

Let's take a look at each of the four occupations that make up the mathematical science occupational group and explore how big data is driving demand for each one.

Actuaries

Employment of actuaries is projected to grow 22.5 percent from 2016 to 2026, much faster than the average for all occupations. However, because it is a small occupation, the fast growth will result in only about 5,300 new jobs over the 10-year period.

The employment trends for actuaries, a mathematical occupation heavily employed in the insurance industry (68.2 percent worked in insurance carriers and related activities in 2016), illustrate how technological change and big data are driving demand for mathematical science occupations.[1] The case of actuaries is best understood by discussing it in the context of similar nonmathematical occupations.

Technological changes often *reduce* the demand for labor, as productivity gains from technology mean that fewer workers are needed to perform the same amount of work. This trend has been happening in the insurance industry for many years. Both insurance underwriters and claims adjusters have experienced reductions in labor demand as computer software programs increasingly perform many of their tasks. From 2016 to 2026, employment of insurance underwriters is projected to decline 5.2 percent and employment of claims adjusters, examiners, and investigators is projected to decline 1.4 percent.

Underwriters and adjusters, like actuaries, are fairly concentrated in the insurance industry (88.8 percent of underwriters and 71.0 percent of claims adjusters, examiners, and investigators worked in insurance carriers and related activities in 2016).[2] Also, like actuaries, their core job functions require analytical skills. The 22.5-percent projected growth rate for actuaries, then, is striking, as this far outpaces the growth for underwriters and adjusters, occupations that are projected to decline over the next 10 years.

A main reason for the divergent effects of technological change on these occupations is the varying level of analytical complexity required for them. Automation technology is advanced enough to assess information on an insurance application and recommend the approval or denial of coverage (a process known as underwriting).[3] In the near future, software will be able to evaluate photographs of property damage and determine the appropriate claim payouts (a process known as claims adjusting).[4] Actuarial analysis, on the other hand, is expected to remain a relatively labor-intensive activity. Actuaries forecast the probability of loss-events occurring, and develop insurance policies that can adequately cover expected costs. In other words, while underwriters and adjusters work on existing insurance policies, actuaries must develop those policies. Actuaries complete a much more complicated task, and while it can be aided by software tools, it cannot be performed by computers alone. Human analytical ability will still be needed.

The increased availability of data opens up new ways to analyze and develop insurance policies. As the *Financial Times* reports, “from weather patterns to social media, new sources of data could help [insurers] streamline costs, be more targeted with the risks they want to underwrite, identify new customers, predict fraud, or identify which claims have the potential to become very expensive.”[5] More effective actuarial work can mean more profitable insurance policies, leading to increased demand for actuaries. Employment of actuaries, then, experiences a sort of inverse-automation effect: rather than reducing demand for these workers, technological advances actually increase it.

Operations research analysts

Operations research analysts are projected to grow 27.4 percent over the next decade, as they benefit from big data.

These workers use advanced mathematical methods to help organizations make decisions in a broad range of areas, including production schedules, pricing, and supply chain management. Businesses are increasingly looking to these workers to use big data in order to develop products and craft marketing campaigns. The analytical software these analysts use has improved recently, making operations research more affordable, and further increasing demand for these workers. Once again, an occupation with highly complex analytical duties has seen its demand for labor increase as a result of advances in technology.

Operations research analysts work in a variety of industries, and their tasks differ based on the work setting. In retail, for instance, they improve inventory management by using consumer data to build models that better anticipate individual purchasing decisions. They also use data to monitor pricing at competitors’ stores and advise price adjustments accordingly.[6] In healthcare, operations research analysts help healthcare providers manage the high demand for their services driven by an aging population and availability of new treatments. These analysts can help develop systems that prioritize patient appointments with providers. The increased use of electronic medical records (EMRs) will add to the amount of data available to operations research analysts; they can use big data to help healthcare providers assess risk and make care plans for patients.[7]

Statisticians

Statisticians are projected to grow the fastest of any occupation in this mathematical group, at 33.8 percent from 2016 to 2026.

Statisticians will be in demand for their ability to develop and analyze big data. These workers apply statistical theory and methods to collect, interpret, and summarize data. They identify trends and relationships in the data in order to provide usable information. They may specialize in certain industries, such as agricultural statistics, business statistics, or economic statistics. With large amounts of new data sources, statisticians will have an important role in ensuring that accurate sampling techniques are used so that datasets can be reliably analyzed.

The field of data science will be a source of particularly high demand for these workers. Data science combines methods from statistics, computer science, engineering, and management. This field aims to build models, make predictions, and recommend actions based on data, rather than just explaining what the data mean. As businesses increasingly look to make decisions with fully formed data analysis and evidence, statisticians who work on actionable predictions will be in high demand.[8] Statisticians working in this field have a similar role to operations research analysts, but their scope is broader than the operations of a business—they can work on broader strategic issues such as business location and which types of products to sell.

Mathematicians

Mathematicians is the smallest occupation in the mathematical sciences group, with employment of 3,100 in 2016. Their projected growth of 29.7 percent is expected to result in only 900 new jobs from 2016 to 2026.

Big data will contribute to the expected continued increase in demand for mathematicians. While some mathematicians conduct research into mathematical theory, others apply mathematical techniques to solve problems in science, management, and other fields. As more sales and business transactions are completed online and as social media and smartphone usage grows, the amount of digitally stored data will also increase. With the vast amounts of new data, mathematical modeling and analysis will become more viable and productive. These workers have substantial employment in government, and they are expected to experience increased demand in the public sector for their ability to develop new analysis to inform policymakers.

Conclusion

As a group, mathematical science occupations are projected to far outpace the average growth rate for all occupations. All four detailed occupations—actuaries, operations research analysts, mathematicians, and statisticians—are expected to see demand increases as the need for their analytical ability increases, particularly as big data becomes more prominent and useful for businesses. While technological progress often substitutes for existing workers, it can create new opportunities for those who use the technology. Mathematical workers are expected to benefit from advances in technology over the projections period to 2026.

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NOTES

[1] Dataset for "Actuaries: Employment by industry, occupation, and percent distribution, 2016 and projected 2026" from the Employment Projections Program (U.S. Bureau of Labor Statistics), https://data.bls.gov/projections/nationalMatrix?queryParams=15-2011&ioType=o.

[2] Dataset for "Insurance underwriters: Employment by industry, occupation, and percent distribution, 2016 and projected 2026" from the Employment Projections Program (U.S. Bureau of Labor Statistics), https://data.bls.gov/projections/nationalMatrix?queryParams=13-2053&ioType=o and dataset for "Claims adjusters, examiners, and investigators: Employment by industry, occupation, and percent distribution, 2016 and projected 2026" from the Employment Projections Program (U.S. Bureau of Labor Statistics), https://data.bls.gov/projections/nationalMatrix?queryParams=13-1031&ioType=o.

[3] LIMRA, "Life Insurers Leverage Technology and Greater Access to Data to Streamline Underwriting, LIMRA Report," 2018, http://www.limra.com/Posts/PR/News_Releases/Life_Insurers_Leverage_Technology_and_Greater_Access_to_Data_to_Streamline_Underwriting,_LIMRA_Report.aspx.

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