

Nebraska Conference for Undergraduate Women in Mathematics

Careers in Mathematics



UNIVERSITY of NEBRASKA-LINCOLN

WHERE ARE THEY NOW?

CURRENT CAREERS OF UNL STUDENTS WHO RECENTLY GRADUATED WITH A BACHELOR'S DEGREE IN MATHEMATICS

- Actuarial Analyst, Actuarial Resources Corporation
- Computer Software Engineer, Fiserv
- Credit Analyst, CoBank
- Equity Research Analyst, Lehman Brothers
- IT Architect/Specialist, IBM
- Programmer, MacPractice
- 2nd Lieutenant Pilot, US Air Force
- Software Engineer, Agile Sports Technology

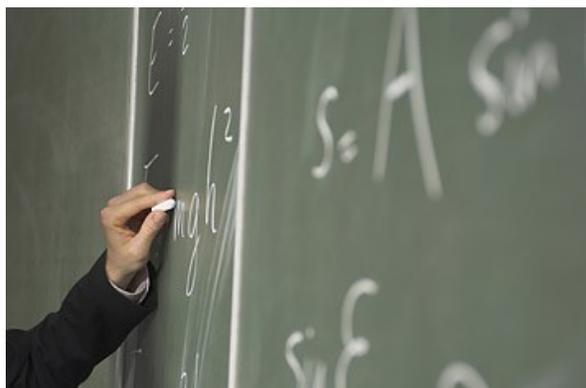
Source: UNL Career Services

What Can My Future Hold with a Math Degree?

CAREERS IN MATHEMATICS

Mathematician: A versatile career

Mastering mathematics is helpful in almost any career. Learning math helps workers analyze and solve problems—abilities that most employers value. And math teaches other important practices, including how to approach tasks methodically, pay attention to detail, and think abstractly.



Some number-focused occupations, such as accountants and cost estimators, are obvious. However, workers in other occupations combine mathematical know-how with knowledge specific to their field. Science, technology, and engineering disciplines, for

example, rely heavily on mathematics. And other disciplines, such as economics, also use math.

Math-intensive occupations include computational biologists, who use statistics to analyze molecular datasets; graphics programmers, who

use vector mathematics to create movies and video games; and patent lawyers, who use mathematical concepts to better understand some inventions.

The level of math needed in occupations ranges from basic calculations to complex mathematical theories. Even in occupations that don't require it, math knowledge can open the door to lots of

careers, says Pearson: "A mathematical background gives you the chance to move in all kinds of directions."

Torpey, Elka. "Math at Work: Using Numbers on the Job." *Math at Work: Using Numbers on the Job* (Fall 2012): 3. *Occupational Outlook Quarterly*. <<http://files.eric.ed.gov/fulltext/EJ990990.pdf>>.

Mathematics majors have a variety of career options. These include diverse choices such as forensic analyst, urban planner, imaging scientist, and actuary. Turn the pages to learn about the many bright futures available to math students.

101 ways to use a mathematics degree

Why does a lawyer need mathematics? Does a doctor need to know equations to have a successful practice?

101 Careers in Mathematics features essays from 101 individuals that discuss the importance of mathematics in their careers. Readers may be surprised that many of these professionals come from a wide range of careers, including doctors, lawyers, economists, consultants, and more. Going beyond the traditional scope of academia lies a multitude of careers that mathematics majors can apply for.

From this book, readers will discover how logic, analytical thinking, recog-

nizing patterns, and the ability to organize data -- the skills learned in a mathematics classroom -- will always be in high demand in the workforce. Read some excerpts from the book:

"I attribute much of my academic success at Columbia University School of Law to having learned, through the study of mathematics... how to analyze complicated principles. Now I practice law in one of the country's largest law firms. I feel I have done well in my job, and I attribute much of that success to my facility with numbers and mathematical theory." - Jonathan Blattmachr, Law Partner, Milbank, Tweed, Hadley & McCloy

"I thoroughly enjoy the career I've chosen, and I have no question that I

wouldn't be here if I had not started my training with a degree in mathematics. The analytical problem-solving skills one develops working through a mathematics curriculum are highly valuable and transferable to any future aspiration." - Marla Prenger, Associate Scientist, Procter and Gamble

"When seeking a mathematical position, don't be put off by titles of jobs or work units that may not seem mathematical. Mathematicians can pop up, and do mathematical work, all over the place." - Michael Weiss, Agricultural Economist, U.S. Department of Agriculture

Source: <http://mathcareers.maa.org/101-ways-use-mathematics-degree>
Admin. "101 Ways to Use a Mathematics Degree." MAA Math Career Resource Center. n.p., 6 Oct. 2016. Web. 02 June 2017.

Math of the penguins

At the bottom of the world, hundreds of thousands of emperor penguins emerge from the sea each April to trek over 50 miles to their inland colonies. After breeding, the females return to the sea for food and the males stay behind, each incubating a solitary egg in a pouch above their feet. Without nests or food, they brave the elements by huddling together on stable pack ice to maximize ambient heat and minimize exposure.

Though dominant winds can appear to push a huddle along the ice, the truth is more nuanced. Penguins in the huddle's center, where temperatures reach a sweltering 100 degrees Fahrenheit, mostly stand still. A bird who finds himself on the huddle's windward side is soon driven to relocate to its warmer, leeward side. As more birds leave the windward side, penguins in the center soon find themselves exposed.

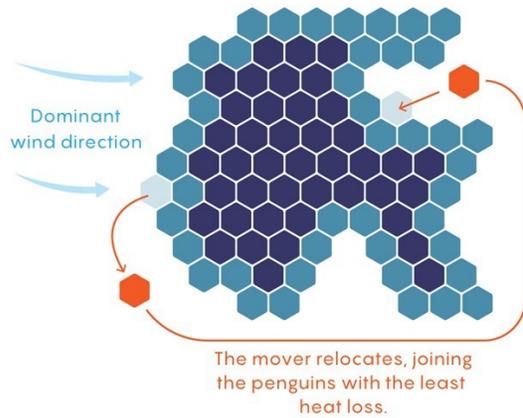
Huddles typically last a few hours, during which the penguins may cycle through multiple rotations from the huddle's cold exterior to its warm interior. In the process, each individual prioritizes his own warmth, yet the huddle's heat is shared by all. Penguins seem to know what mathematicians learned long ago: The densest packing of shapes on a plane is a hexagonal grid. According to François Blanchette, a mathematician at the University of California, Merced, and his team, the birds arrange themselves as if they were each standing on their own hexagon in a grid, as shown in

Blanchette's model. The mover selects the leeward-side boundary penguins with the least heat loss as his new neighbors, assuming his new spot without disturbing others. As he settles in, one or more of his new neighbors may now be situated in the huddle's interior, without ever having moved. Meanwhile, on the windward side, the mover may have exposed a formerly interior penguin to the boundary by leaving his old spot vacant.

As more penguins embark on heat-seeking missions, the huddle's boundary is in constant flux. Over time, rough shapes in the huddle become defined. The original blob transforms into a regular geometric object: an oblong shape with straight sides and rounded ends. Without knowing it, the birds have stumbled into an almost perfect arrangement.

Daniel Zitterbart, a physicist at Woods Hole Oceanographic Institution, helped develop and install high-resolution cameras to observe undisturbed huddling behavior. Zitterbart's team has developed mathematical models that accurately forecast penguin huddles.

"For us, the relevant part is, 'How is the penguin feeling?' because how the penguin is feeling dictates how the penguin behaves. And we measure behavior," Zitterbart said. To do this, his team developed a notion of "apparent temperature," which reflects how ambient



temperature, humidity, wind speed and solar radiation affect a penguin's perception of the temperature. They also had to consider how far into the breeding cycle the penguins were, since earlier in the cycle the birds are plumper from recent foraging, which allows them to start huddling at relatively colder temperatures.

Zitterbart believes penguin huddles are so mathematically precise that the apparent temperature at which they transition into a huddle serves as an indirect measure of the penguins' average fat content and energy reserves. His team is now working to determine whether the initial huddling temperature also reveals changes in colony health over time.

"All we'd need to do is take pictures of huddling penguins, which, compared to taking a research vessel and driving around and fishing, would be much less money," Zitterbart said. "This is an area of active science."

Full article: <https://www.quantamagazine.org/math-of-the-penguins-20200817/>

Dream job: Restocking fish in the ocean with math

Fish provide an important source of protein in the U.S. and the world. It is important to manage the oceans well so that global economies can maximize the amount of fish that can be sustainably harvested. In graduate school, Allison DeLong learned quantitative ecology can help oceanographers and resource managers better manage ocean wildlife populations.

Humans do not have the best track-record in keeping the balance of wildlife population and commercial exploitation. This leads to species being threatened and endangered, like several Pacific salmon stocks. In her work, DeLong combines her knowledge of ecology, biology with statistics and linear algebra to help come up with management strategies that will support ocean fish and wildlife populations.

Since 1997, DeLong has been working as a Marine Research Associate at the University of Rhode Island graduate school of oceanography. One of her recent projects was extending and hopefully improving the model currently used by the Alaska Department of Fish and Game to estimate several king crab stock abundances. Each year a population quota is mathematically calculated for commercial harvesting based on the population threshold of king crabs who are a certain size.

DeLong is also works on projects to develop a dynamic model to describe the stock growth and decline of the crabs. The hope is to better understand the relationship between exploitation and predation on crab populations. DeLong uses her mathematical model to determine if the crab

populations can return to their pre-fished size.

Allison DeLong is a Marine Research Associate at the University of Rhode Island Graduate School of Oceanography. She earned her bachelor's degree at Grinnell College and her masters in Mathematical Modeling Option of the Environmental Systems at Humboldt State University.



Source: <http://mathcareers.maa.org/dream-job-restocking-fish-ocean-math-Admin>. "Dream Job: Restocking Fish in the Ocean with Math." *Dream Job: Restocking Fish in the Ocean with Math* | MAA Math Career Resource Center. MAA, 28 Oct. 2016. Web. 02 June 2017.

Corporate world offers career options

“Working in industry provides the opportunity to apply mathematics to real world problems and to actually use the results of analysis to resolve difficulties in building a product or delivering a service.”

- William Hammers

Many business professionals need a strong mathematical background to succeed at their jobs. Mathematically intensive careers in the corporate world usually focus on one of three areas. First, companies often need models and forecasts for the future so that they can be prepared. Second, the marketing division of companies collect statistics on clients and use this data to find trends. Finally, financial mathematics and the ability to calculate quickly is essential to various types of stockbrokers.

For a company to be successful, a company must be prepared for the future. To help make important business decisions, most companies

create models to forecast revenue and sales for the coming years. A variety of careers which make forecasts for businesses include cost estimators, risk analysts, inventory control specialists, budget analysts, operations research analysts, economists, and actuaries.

The marketing division of a company identifies the target audience of a business by discovering the characteristics of the most profitable customers. Market research analysts use their mathematical skills to recognize trends in data, and thus help their company have more successful, profitable marketing campaigns.

Stockbrokers must understand financial mathematics, so they can help their clients make good investment decisions. Financial exchange traders and other types of traders must be able to accurately compute problems involving large sums of money quickly because trading floors are fast-paced environments.

William Hammers, the Chief Financial Officer of Optimal Solutions, told the Mathematical Association of America, “Working in industry provides the opportunity to apply mathematics to real world problems and to actually use the results of analysis to resolve difficulties in building a product or delivering a service.”

Best Jobs of 2021

1. Data Scientist
2. Genetics Counselor
3. Statistician
5. Mathematician
6. University Professor
7. Operations Research Analyst
9. Actuary

Source: “Best Jobs of 2021” by CareerCast.com

Actuaries quantify risk

An actuary is a business professional who deals with the financial impact of risk and uncertainty. Actuaries apply mathematical and statistical theories to solve real business problems. Actuaries assemble and analyze data to estimate the probability and likely cost of an event such as death, sickness, injury, disability, or loss of property. They also address financial questions, including those involving the way a company should invest its resources to maximize its return on investments.

Actuaries are in high demand, and they are often highly paid for the services they render.

Actuaries are essential to the insurance industry; to other businesses and corporations, including sponsors of pension plans; and to government agencies, such as the Government Actuary’s Department in the UK or the Social Security Administration in the U.S.

They are paid well for their services with low-end salaries of \$55,780 per year, median salaries of \$93,680 per year, and high-end salaries of \$175,330 per year.

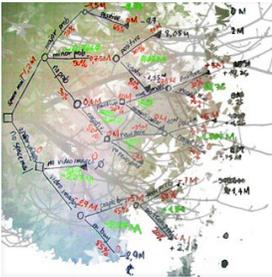
Most actuaries major in either actuarial science or mathematics. Regardless of major, actuaries need a strong foundation

in mathematics, statistics, and general business. They generally have a bachelor’s degree and are required to pass a series of exams in order to become a certified actuary.

Janet P. Denbleyker, a consulting actuary for Buck Consultants, told the Mathematical Association of America, “My advice to someone interested in the actuarial profession: talk to many actuaries in different areas of the industry to get a feel for what is right for you ... A career as an actuary can be very interesting and rewarding.”

Source: <http://weusemath.org>

Operations research analysts do strategic planning



Robin Roundy describes his job as “the application of mathematics to business management.”

Operations research analysts are involved in top-level strategizing, planning, and forecasting. They use advanced techniques from mathematics, science, and engineering to

make better decisions and to solve problems. These analysts help to allocate resources, measure performance, design production facilities and systems, manage the supply chain, set prices, coordinate transportation and distribution, and analyze large databases. They also have been used in wartime for various services including searching for enemy submarines.

\$132,500 per year.

Robin Roundy, an operations research analyst, said, “I deal with the modeling, mathematical theory and algorithmic aspects of inventory control, production planning, production scheduling, forecasting and capacity management.”

Source: <http://weusemath.org>

Operations research analysts receive low-end salaries of \$43,520 per year, median salaries of \$78,630 per year, and high-end salaries of

Foreign exchange traders calculate quickly

A foreign exchange trader looks at the various factors that influence local economies and rates of exchange, and then takes advantage of any misvaluations of currencies by buying and selling in different foreign exchange markets.

“It’s the wild west of trading,” one trader told the Princeton Review.

Foreign exchange traders receive low-end salaries of \$90,008 per year, median salaries of \$154,786

per year, and high-end salaries of \$204,723 per year.

Mathematics, economics, and statistics majors have a distinct advantage in applying for positions in this field, as do history majors whose coursework included economics. Any experience in a trading environment is valued, as is any work that demonstrates the ability to work hard, make fast and accurate decisions, and manipulate numbers. Many employers appreci-

ate study abroad, international work experience or fluency in a foreign language.

Foreign exchange traders must act fast to exploit valuation differences: “You’ve got seconds to decide how millions of dollars should be spent,” said one trader, “so you have to have confidence.” Confidence ranked second right after “guts” in qualities important in new traders.

Source: <http://weusemath.org>

Market research analysts identify trends

Market researchers gather information about what people think. They help companies understand what types of products people want and at what price. They also help companies market their products to the people most likely to buy them. Gathering statistical data on competitors and examining prices, sales, and methods of marketing and

distribution, they analyze data on past sales to predict future sales.

Market research analysts receive low-end salaries of \$33,530 per year, median salaries of \$62,150 per year, and high-end salaries of \$120,460 per year.

Bob Anastasio, a director of marketing, told the Mathematical

Association of America, “If you are interested in this more applied side of mathematics, you should consider taking some business courses (marketing, finance, accounting) in addition to applied mathematical courses like Probability and Statistics, and Operations Research.”

Source: <http://weusemath.org>



“By applying statistical techniques ... I was able to help my employers optimize return on investment in their marketing campaigns.”
- Bob Anastasio

“5 of the 6 ‘Best Jobs’ in terms of low stress, high compensation, autonomy, and hiring demand in the ‘Job Related Almanac’ by Les Krantz are all math related.”

-weusemath.org

Mathematics used in scientific fields

Mathematical skills are vital for most scientists, and for those interested in both science and mathematics, a variety of career options are available in any scientific field.

For those interested in biology, careers for mathematics majors can include biologist, biostatistician, computational biologist,

mathematical biophysicist, physician, and epidemiologist.

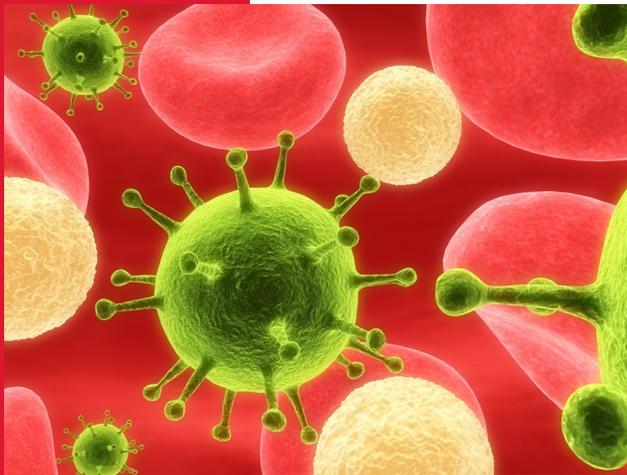
A variety of scientific careers require upper-level mathematical backgrounds including research scientists, astronauts, climatologists, forensic analysts, geologists, and environmental mathematicians.

A firm foundation in mathe-

matics can be the stepping stone to great success in a scientific field whether one is pursuing further education or working in industry.

Geologist, Kitty Milliken, Ph.D., said, “Take a lot of math. Math is incredibly important in science. I wish I’d taken even more math in college than I did, and I had a math minor!”

Biostatisticians design research studies



“What I do is interesting, I feel that I’m making a contribution, I enjoy working with doctors doing medical research.”

**-Mike Liebev
Biostatistician
Cleveland Clinic
Foundation**

Biostatisticians design research studies and analyze data related to human health, animals or plants. The healthcare, biomedical, and pharmaceutical fields employ biostatisticians who are responsible for analyzing genetic data, disease occurrence, and medical imaging data. These biostatisticians develop clinical trials to assess drug treatments. Other academic and government biostatisticians analyze data of

populations exposed to environmental chemicals and conditions to understand their risks and effects.

Biostatisticians receive low-end salaries of \$54,681 per year, median salaries of \$77,860 per year, and high-end salaries of \$130,916 per year.

A bachelor’s degree is sufficient for entering the field of Biostatistics as an assistant. However, most Biostatisticians have M.S. or Ph.D. degrees in Biostatistics, Statistics, or Applied Mathematics.

Biostatisticians collaborate with researchers as they design studies, helping them find the best approach to data gathering given the question the researchers are trying to answer. These statisticians provide advice on such topics as sample size and data collection (what methods will be used to gather the data).

Once the raw data have been gathered, biostatisticians use statistical software to turn the data into useful information. They use standard statistical procedures and terms to help researchers pinpoint which results were significant and which were inconclusive, warranting further study. Biostatisticians sometimes find themselves cleaning up an imperfect data set to help researchers glean conclusions from it.

Mike Liebev, a biostatistician for Cleveland Clinic Foundation, told the Mathematical Association of America, “I consider myself very fortunate to be doing this kind of work. What I do is interesting, I feel that I’m making a contribution, I enjoy working with doctors doing medical research, and the work is neither stressful nor strenuous.”

Source: <http://weusemath.org>

Climatologists model future weather patterns

Climatologists study climate conditions averaged over a period of time. They use climate models for a variety of purposes, from the study of the dynamics of the weather and climate system to projections of future climate. In contrast to meteorology, which focuses on short term weather systems lasting up to a few weeks, climatology studies the frequency and trends of those

systems. Climatology considers the past and can help predict future climate change.

Climatologists receive low-end salaries of \$50,630 per year, median salaries of \$89,820 per year, and high-end salaries of \$132,180 per year.

Climatologists need to have a strong

background in mathematics and science. In fact, a bachelor's degree in mathematics provides excellent preparation for graduate study in climatology. Climatologists often pursue higher education by obtaining a master's degree and a Ph.D.

Source: <http://weusemath.org>



Forensics analysts help solve crimes

Forensic analysts use scientific techniques to solve criminal cases. They may use traditional methods such as fingerprinting, assisted by computers, in addition, blood analysis, forensic dentistry, voice and speech spectrograms, and genetic fingerprinting. Chemicals, such as poisons and drugs, are analyzed by chromatography and ESDA (electrostatic document analysis) is a technique used for revealing indentations on paper, which helps determine if documents have been tampered with.

A forensic analyst uses bloodstain pattern analysis in order to tell the story of the crime. It turns out that

the location where the blood lands, and the shape of the blood on the landing surface, reveal both the direction in which the blood was moving and how much force was used to wound the victim. Analysts use math principles to figure out the location of the victim when the blood was shed and even the type of weapon or impact that caused the victim's injury. Math is also used to establish the range of time of death based on the temperature of the body when it was found and to measure other changes in the body occurring at the time of death.

The UNL Forensics Science website states, "Some of this science is inher-

ently intriguing and is used as the basis for countless television shows, novels, and movies. The analysis of human remains to estimate sex, age, and stature might fall into this category. In contrast, some forensic science would result in very short-lived television programming. This might include determining the number of insect parts in a can of processed food."

Forensic analysts receive low-end salaries of \$34,000 per year, median salaries of \$56,320 per year, and high-end salaries of \$94,410 per year.

Source: <http://weusemath.org>

"Some of this science is inherently intriguing and is used as the basis for countless television shows, novels, and movies."
-UNL, Department of Forensic Science

Dream job: Using geometry to filter water

Waste filters are not the most exciting product but they are vital to modern life: people rely on clean, flowing water free of garbage. What people may not know is that the geometry of these waste filters is key to catching all the debris, while keeping water flowing freely.

That is where Sumanth Swaminathan came in. With his colleagues at W.L. Gore & Associates, which makes a range of industrial and medical products like Gore-Tex and Glide dental floss, Swaminathan combined geometry and fluid dynamics to improve waste filters.

His team used network theory to optimize the filter's ability to catch garbage in the water.

Simulating particle and fluid flow through the filter to see where they land, he helped mathematically optimize the microstructure in the improved filters.

"The geometry is really complicated so we had to do some additional mathematics just to understand what's inside the images of the filters," said Swaminathan who earned his Ph.D in applied mathematics at Northwestern University. Then Swaminathan translated the physical explanation from the simulations into a calculation, which was then used to build a model of the new filter.

This process, building new models from mathematical calculations, saves both time and re-

sources in the actual building side of material science. Instead of building prototype after prototype, the researchers can get closer and closer to the finished product, so when it is ready for testing it is nearly ready to be used. The same steps Swaminathan used to produce a waste filter can be applied to new products like guitar strings or dental floss.

Now as Chief Data Scientist for Revon Systems, Swaminathan develops machine learning algorithms for early predictions of disease exacerbations in patients with chronic illnesses. The algorithms also predict what advice to give patients and what medical help to seek.

Source: <http://mathcareers.maa.org/dream-job-using-geometry-filter-water>

Math is basis of computer science

“The top 15 highest-earning college degrees all have one thing in common -- math skills. That's according to a recent survey from the National Association of Colleges and Employers, which tracks college graduates' job offers.”

Computer scientists work as theorists, researchers, or inventors. They use innovation to solve complex problems and create or apply new technology. The areas of computer science research range from complex theory to hardware design to programming-language design. Some researchers work on projects such as developing and advancing uses of virtual reality, extending human-computer interaction, or designing robots.

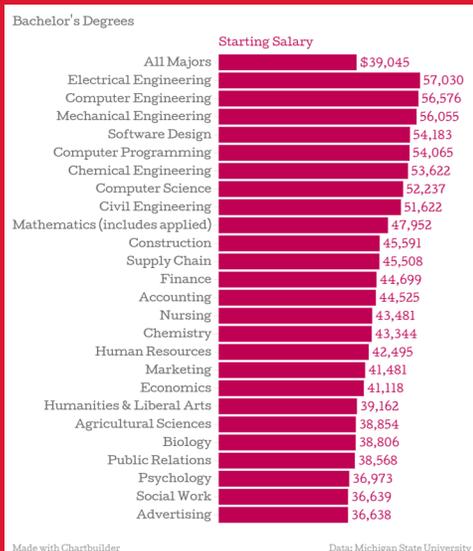
Knowledge of mathematics is necessary for any complex work involving computer science.

Various careers are open to those interested in pursuing both their passion for mathematics and computer science. These careers include computer scientist, imaging scientist, software engineer, staff systems analyst, modeling and simulation analysts and system engineer.

Michael Murray, a Java developer, told the Mathematical Association of America, “Without a solid mathematical base, the most talented of programmers can easily get lost when all these numbers start flying around.”

Source: <http://weusemath.org>

Starting Salaries by Major for the Class of 2015



Source: The College Degrees With The Highest Starting Salaries in 2015 by Susan Adams for forbes.com.

Video game pioneer keeps creating

Making a video game is an odd mixture of science and art, and you never know what problem you'll be asked to solve next. That sort of challenge is exactly why Kathie Flood loves her job as the managing director and CEO of Cascade Game Foundry.

Kathie describes her career path as “accidental.” She loved arcade games but didn't realize that it was possible to get an actual job in game design. After several years working as a technical writer, Kathie realized she wanted to be a part of the design and development process of software rather than the backend. So she moved into project management. “I was in the right place (Microsoft) at the right time (mid-'90s) with the right skills (technology background, project design and management experience) and interests (sports) when Microsoft decided to get into the entertainment software business.”

From 1994 to 2009, Kathie worked at

Microsoft, ultimately becoming a program manager. She enjoyed being able to focus on one game from start to finish and participating in every aspect of the game's design and production.



Kathie's background in mathematics is instrumental to her work.

It allows her to have a strong understanding on the higher-level mathematics necessary to create realistic physics 3D graphics in her games. This helps her work with the programmers and artists creating these features so she can better understand the challenges they face. The problem-solving skills she learned while studying mathematics help her

break down complex problems into smaller, more manageable parts, find creative solutions, and execute them.

With an interest in creating video games for people outside of the core demographic, Flood developed “Infinite Scuba,” a game in which a scuba diver encounters undersea animals and artifacts that need to be unlocked. The main character is a woman.

When asked what she enjoys most about her job, Flood responds that she loves bringing order to chaos and seeing people enjoy the games that she helps create. “And, when people ask me what I do for a living, I love to see their eyes light up when I say I make video games!” I never got that reaction when my answer was “I write technical reference guides for programmers!”

Source: <http://mathcareers.maa.org/dream-job-video-game-pioneer-keeps-creating> Admin. “Dream Job: Video Game Pioneer Keeps Creating.” *Dream Job: Video Game Pioneer Keeps Creating* | MAA Math Career Resource Center. MAA, 27 Feb. 2017. Web. 02 June 2017.

Electrical engineers develop electrical equipment

Electrical engineers design, develop, test, and supervise the manufacture of electrical equipment. Some of this equipment includes electric motors; machinery controls, lighting, and wiring in buildings; automobiles; aircraft; radar and navigation systems; and power generation, control, and transmis-

sion devices used by electric utilities.

Electrical engineers receive low-end salaries of \$59,240 per year, median salaries of \$93,010 per year, and high-end salaries of \$146,820 per year.

Electrical engineers use laws of nature that are mathematical expressions such as Maxwell's equations for electromagnetics and Kirchhoff's Rules for circuit analysis.

Source: <http://weusemath.org>



Engineering covers diverse fields

Aspiring engineers have diverse options when choosing what type of engineering major they wish to pursue.

For example, the University of Nebraska-Lincoln offers undergraduate majors in architectural engineering, agricultural engineering, biological systems engineering, chemical engineering, civil engineering, computer engineering, construction engineering, electrical engineering, electronics

engineering, industrial engineering, and mechanical engineering. There are more options for careers beyond these such as petroleum engineering and applications systems engineering.

For those interested in pursuing a career in engineering, the BYU Mathematics Department lists the following required education, "Engineers typically enter the occupation with a bachelor's degree in mathematics or an engineering specialty, but some basic

research positions may require a graduate degree. Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and the physical and life sciences. Engineers offering their services directly to the public must be licensed. Continuing education to keep current with rapidly changing technology is important for engineers."

"Among the top 10 most sought after college graduates by companies right now are electrical engineers, mechanical engineers, computer engineers and civil engineers."
-UNL, College of Engineering

Mechanical engineers create machines

Mechanical engineers research, design, develop, manufacture, and test tools, engines, machines, and other mechanical devices.

Mechanical engineering is one of the broadest engineering disciplines. Engineers in this discipline work on power-producing machines such as electric generators, internal combustion engines, and steam and gas turbines. They also work on power-using machines such as refrigeration and air-conditioning equipment, machine tools, material handling systems, elevators and

escalators, industrial production equipment, and robots used in manufacturing.

Mechanical engineers receive low-end salaries of \$53,640 per year, median salaries of \$83,590 per

year, and high-end salaries of \$128,430 per year.

According to the University of Nebraska-Lincoln's Department of Engineering's website, "Mechanical engineers deal with

a wide realm of motion, all forms of energy conversion and transmission; the flow of fluids and heat; the development, design and operation of machinery and equipment; material structure and properties; and transportation processes."

Source: <http://weusemath.org>



Mathematics is vital to many careers

"It's a lot more than just some boring subject that everybody has to take in school... It's the science of problem-solving."

-Jennifer Courter

A major in mathematics prepares students for a wide variety of careers. Besides the wealth of opportunities in business, science, computer science, and engineering, mathematics majors have a diverse group of options.

traffic controller, animator, architect, attorney, cartographer, cryptanalyst, geographer, national security analyst, political scientist, psychometrician, statistician, technical writer, urban planner, and teacher.

Jennifer Courter, a research mathematician at mental images Inc., a maker of 3D-visualization software in San Francisco, quoted in the article, *Doing the Math to find the Good Jobs*, by Sarah Needleman, which appeared in the Wall Street Journal on January 6, 2009. "It's the science of problem-solving."

"It's a lot more than just some boring subject that everybody has to take in school," says

Possible careers include air

Air traffic controllers direct pilots



Air traffic controllers coordinate the movement of air traffic to make certain that planes stay a safe distance apart. Their immediate concern is safety, but controllers also must direct planes efficiently to minimize delays. Some regulate airport traffic through designated airspace; others regulate airport arrivals and departures.

end salaries of \$171,340 per year.

A degree in mathematics is a great way to start a career as an air traffic controller. To become an air traffic controller, a person must also complete an FAA-approved education program; pass a pre-employment test; receive a school recommendation; meet the basic qualification requirements in accordance with Federal law; and achieve a qualifying score on the FAA-authorized pre-employment test.

Air traffic controller uses math in order to be able to understand distances and measurements at a moment's notice. They also must be able to do mental math quickly and accurately. Part of their job is directing aircraft at what altitude and speed to fly. An error in these directions could be fatal so a strong math background is important. In addition, gaining computer skills is essential in order to work with special computer programs and automated instruments.

Source: <http://weusemath.org>

Air traffic controllers receive low-end salaries of \$64,930 per year, median salaries of \$122,530 per year, and high-

"I thoroughly enjoy the career I've chosen, and I have no question that I wouldn't be here if I had not started my training with a degree in mathematics. The analytical problem-solving skills one develops working through a mathematics curriculum are highly valuable and transferable to any future aspiration."

*-Marla Prenger
Associate Scientist
Proctor and Gamble*

Urban planners design cities

Urban planners develop long- and short-term plans for the use of land and the growth of urban, suburban, and rural communities and the region in which they are located. They help local officials by recommending locations for roads, schools, and other infrastructure and suggesting zoning regulations for private

property. This work includes forecasting the future needs of the population.

Urban planners receive low-end salaries of \$42,940 per year, median salaries of \$68,220 per year, and high-end salaries of \$102,200 per year.

Urban designers use math as

they design the arrangement, appearance, and functionality of towns and cities, and in particular, the shaping and uses of safe public space. Also, urban designers use mathematical models to forecast the future needs of a group of people.

Source: <http://weusemath.org>

Psychometricians write standardized tests

A psychometrician is a person who practices the science of measurement, or psychometrics. The term psychometrics refers to the measurement of an individual's psychological attributes, including the knowledge, skills, and abilities a professional might need to work in a particular job or profession. Also, psychometricians write exams such as the MCAT, LSAT, GMAT, SAT, ACT, and Advance Placement test.

Typically, many psychometricians work for testing organizations.

They initially determine the abilities, skills and knowledge needed to do the job and create the specifications of the test. They then write test questions and determine the passing score. They may also perform data analyses on the test results as well as conducting validity and reliability studies. College Board, the company that writes the SAT and Advance Placement tests, employ psychometricians.

Psychometricians receive low-end salaries of \$33,000 per year,

median salaries of \$69,000 per year, and high-end salaries of \$105,000 per year.

The minimum requirements for the position of a psychometrician are a Master's degree in educational measurement, industrial/organizational psychology, mathematics, or related area with relevant experience and training. A Ph.D. in a relevant field is highly desirable.

Source: <http://weusemath.org>

“Cryptanalysis is one of the core technical disciplines necessary for the NSA to accomplish its mission and provide critical intelligence to the Nation’s leaders.”

-www.nsa.gov

Cryptanalysts develop coding systems

Cryptanalysts design, implement, and analyze algorithms for solving problems. They analyze and decipher secret coding systems and decode messages for military, political, or law enforcement agencies or organizations. They help provide privacy for people and corporations, and keep hackers out of important data systems. They are constantly working on new ways to encrypt information.

Cryptanalysts receive low-end salaries of \$38,930 per year, median salaries of \$76,470 per year, and high-end salaries of \$112,780 per year.

Cryptanalysts use math to perform many tasks including studying and testing ideas and alternative theories, following mathematical theorems, encoding and encrypting systems and databases, performing

cryptic computations and applying methods of numerical analysis, devising systems for companies to help keep hackers out and to protect the company and consumer, using computers to make graphs, tables and charts of data, acting as consultant to research staff concerning cryptical and mathematical methods and applications.

Source: <http://weusemath.org>

Technical writers need superior writing skills

A technical writer is a professional writer who designs, writes, creates, maintains, and updates technical documentation including online help, user guides, white papers, design specifications, system manuals, and other documents.

Technical writers work for book, magazine, or newspaper publishers, or they may be employed in other

industries. Technical writers who work for the federal government write the pamphlets that are published by the Government Printing Office. These pamphlets cover many different fields, including the activities of various government agencies and the developments in research in such areas as medicine, education, and agriculture. Some technical writers work for colleges

or universities or for the publishers of professional journals. Others work for advertising agencies.

Technical writers receive low-end salaries of \$41,610 per year, median salaries of \$70,240 per year, and high-end salaries of \$112,220 per year.

Source: <http://weusemath.org>



NCUWM

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