Career Paths in Mathematics, Applied Math and Statistics

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What is Mathematics?

- **Mathematics** is a field of study that discovers and organizes abstract objects, methods, theories and theorems that are developed and proved for the needs of empirical sciences and mathematics itself.

- Math majors learn how to express themselves logically, how to use math and technology to solve problems, and how to use statistics to analyze quantitative information.

- Two broad categories:

    Theoretical (pure) mathematics

    Applied mathematics

Sources:
https://www.sjsu.edu/math/student-resources/advising/mathematical-careers.php
https://en.wikipedia.org/wiki/Mathematics

What is Applied Mathematics?

- **Applied mathematics** is the application of mathematical methods by different fields such as physics, engineering, medicine, biology, finance, business, computer science, social sciences, government, and industry.

  → Applied mathematics is a combination of mathematical science and specialized knowledge (application).

- Use theories and techniques, such as **mathematical modeling** and **computational methods**, to formulate and solve problems in the different fields listed above.

Sources:
https://www.sjsu.edu/math/student-resources/advising/mathematical-careers.php
https://en.wikipedia.org/wiki/Applied_mathematics

What is Statistics and Data Science?

- **Modern statistics:** the science of collecting and analyzing data, and making inferences from data.

  → The fundamentals of statistics are rooted in the **probability theory**.

- **Data science**: developed with the need to analyze big data sets.

- Interdisciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from noisy, structured and unstructured data, and apply knowledge from data across a broad range of application domains.

- A "concept to unify statistics, data analysis, informatics, and their related methods" in order to "understand and analyze actual phenomena" with data.

Sources:
https://www.sjsu.edu/math/student-resources/advising/mathematical-careers.php
https://en.wikipedia.org/wiki/Statistics and https://en.wikipedia.org/wiki/Data_science
Slides from Dr. Kozubowski ☺

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A **data scientist** is a professional who creates programming code and combines it with statistical knowledge to create insights from data.

What can I do with a degree in math or statistics?

- Mathematics, statistics, and computational science are utilized in almost every discipline of science, engineering, industry, and technology.

- What kinds of problems might you work on?

- While careers in math / stats may differ widely by discipline and job title, one thing remains constant among them — **problem solving**.

Sources:
https://www.siam.org/students-education/programs-initiatives/thinking-of-a-career-in-applied-mathematics
https://www.sjsu.edu/math/student-resources/advising/mathematical-careers.php

HERE ARE SOME EXAMPLES OF ORGANIZATIONS THAT HIRE MATHEMATICIANS AND COMPUTATIONAL SCIENTISTS:

- ACADEMIC INSTITUTIONS AND RESEARCH INSTITUTES
- AEROSPACE AND TRANSPORTATION EQUIPMENT MANUFACTURERS OR SERVICE PROVIDERS
- ANALYTICS AND FORECASTING ORGANIZATIONS
- CHEMICAL OR PHARMACEUTICAL MANUFACTURERS
- COMMUNICATIONS SERVICES PROVIDERS
- COMPUTER INFORMATION AND SOFTWARE FIRMS; ESTABLISHED OR START-UPS
- CONSUMER PRODUCTS COMPANIES
- ENERGY SYSTEMS FIRMS
- ELECTRONICS AND COMPUTER MANUFACTURERS
- ENGINEERING RESEARCH ORGANIZATIONS
- FINANCIAL SERVICE AND INVESTMENT MANAGEMENT FIRMS
- GOVERNMENT LABS, RESEARCH OFFICES AND AGENCIES
- INSURANCE COMPANIES
- MEDICAL DEVICE COMPANIES
- PRODUCERS OF PETROLEUM AND PETROLEUM PRODUCTS

POSSIBLE JOB TITLES FOR PEOPLE WITH APPLIED MATH & COMPUTATIONAL SCIENCE BACKGROUNDS AND EDUCATION:

- Actuary
- Analyst
- Analytics Consultant
- Analytics Manager
- Applied Mathematics Researcher
- Associate Editor
- Biostatistician
- Business Analyst
- Business Intelligence Developer
- Claims Specialist
- Consultant
- Cryptanalyst
- Cryptographer
- Data Analyst
- Data Engineer
- Data Operations Associate
- Data Processing Specialist
- Data Scientist
- Director of Math Tutorial Curriculum
- Engineer
- Forecast Analyst
- Functional Analyst
- Game designer/slot game designer/game mathematician
- Geolocation Engineer
- Global Pricing Analyst
- Guidance and Navigation Engineer
- Informatics Scientist
- Information Analyst
- Investment Analytics Quant
- Manager
- Math Curriculum Coach
- Math Curriculum Consultant
- Mathematician
- Modeler
- Modeling Engineer
- Operations Researcher
- Operations Support Specialist
- Pharmacokineticist
- PK/PD Modeler
- Planner
- Principal Scientist
- Product Manager
- Program Manager
- Programmer
- Project Manager
- Quality Systems and Compliance Manager
- Quantitative Analyst
- Quantitative Developer
- Quantitative Pharmacologist
- Quantitative Researcher
- Quantitative Scientist
- Quantitative Software Engineer
- Reporting Engineer
- Research and Development Engineer
- Research Analyst
- Researcher
- Research Scientist
- Risk Analyst
- Risk Strategist
- Scientist
- Simulation Engineer
- Software Engineer
- Staff Scientist
- Statistician
- Strategist
- Supply Chain Analyst
- Systems Engineer
- Technical Staff
- Tutor

Some applications to work on…

- How can an **airline** use smarter scheduling to reduce costs of aircraft parking and engine maintenance? Or smarter pricing to maximize profit?

- How can **automotive and aircraft companies** test performance, safety, and ergonomics, while at the same time lowering the cost of construction and testing prototypes?

- A **pharmaceutical company** wants to search a very large database of proteins to find one that is similar in shape / activity to one they have discovered. What's the most efficient way to do so?

- How do we use major advances in computing power to incorporate knowledge about interactions between the **oceans, the atmosphere and living ecosystems** into models used to predict long-term change?

- How might **disease spread** in populated areas in the event of a bioterrorism event, and how would it be contained?

- Can we measure sentiment change as a result of **social media** shares, likes and comments?

- How can you allocate an **investment** among various financial instruments to meet a risk/reward trade-off?

Some applications to work on…

- Can mathematical models be coupled with efficient computational implementations to obtain practical, low-cost simulations to guide **computer chip design and manufacture**?

- How can genome sequencing analysis help in making clinical decisions based on a **personalized medicine** approach?

- How can mathematics improve rating prediction performance of **e-commerce systems** and help enhance the consumer experience based on their past purchases, behavior and interests?

- Can we provide insight to **coastal communities** about future sea level rise and the risk and likelihood of effects of climate related events on their communities?

- How can you mathematically model the **spread of a forest fire** depending on weather, ground cover and type of trees?

- How do you design a **robotic hand** to grip a coin and drop it in a slot?

Former students & friends with math / applied math degrees have jobs at:

- Academic institutions
- K-12 math teacher
- Google; Apple; Yahoo
- Boeing
- 3M
- NSA (National Security Agency)
- Las Alamos National Lab
- FDA (US Food and Drug Administration)
- USDA (US Dept of Agriculture)
- NV Dept of Health and Human Services

- Pharmaceutical companies: Pfizer, Norvartis
- Volvo IT
- Stitch Fix
- LinkedIn
- Consulting
- Wall street jobs
- Banks – risk analysis
- Gaming industry: IGT, Peppermill, Light and Wonder
- Lawyer
- Seamstress; Costume designer

Former students & friends with statistics degrees have jobs at:

- Academic institutions
- Google; Apple
- Amazon – analytics
- Government – US Dept of Labor
- USDA (US Dept of Agriculture)
- Insurance companies – actuarial work, health insurance
- Renown – health data analysis
- Banks – data analytics
  e.g. Credit One Bank, Las Vegas
- Investment banking – data analysis, strategy

- NV Energy
- HBO Max
- Jobs in Data Science; Machine Learning, AI, experimentation

Public health / Health care:

- NV Dept of Health and Human Services
- Nevada Central Cancer Registry (NCCR)
- Medical Information Bureau, NYC
- Personalized medicine

Why Study Statistics?

Change the World: From protecting endangered species and managing the impacts of climate change to making medicines more effective and reducing hunger and disease.

Have Fun: Careers in statistics are fun! You could be a "Moneyball"-style statistician or a member of the data science team of a U.S. presidential campaign.

Satisfy curiosity: Statistics is a science. If you are curious about how things work, statistics is a career that will keep your curiosity piqued and your brain engaged.

Make money: Demand for statisticians and data scientists is growing, and so are their salaries. The median salary for statisticians is $92,030, according to 2019 Bureau of Labor Statistics data.

Adapted from the American Statistical Association web page   Slide courtesy of Dr. Kozubowski

Job opportunities in statistics and data science
One of the most in-demand career paths in technology

In 2020, IBM predicted that there would be 2.7 million open jobs across data science and related careers and that there would be a 39 percent growth in employer demand for data scientists and data engineers

Job opportunities all around, including financial industry, insurance industry, health industry, marketing, US government, research, and education to name just a few.

- **Data Scientist:** Number 1 in BEST JOBS by Careercast, #3 on Glassdoor.

  Median salary: $98, 230; Projected growth: 33%

- **Statistician:** Number 3 in BEST JOBS by Careercast

  Median salary: $92, 270; Projected growth: 35%

Slide courtesy of Dr. Kozubowski
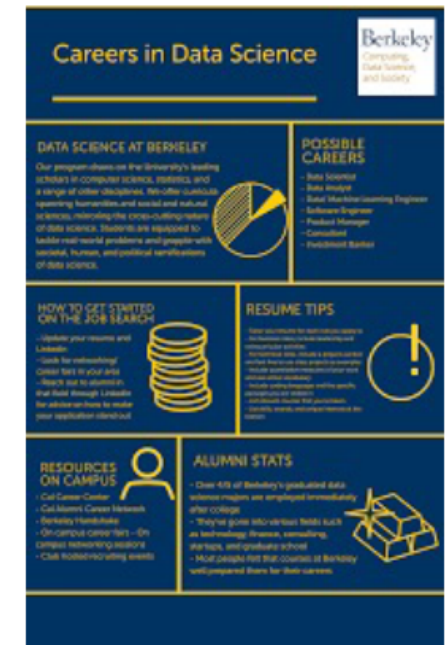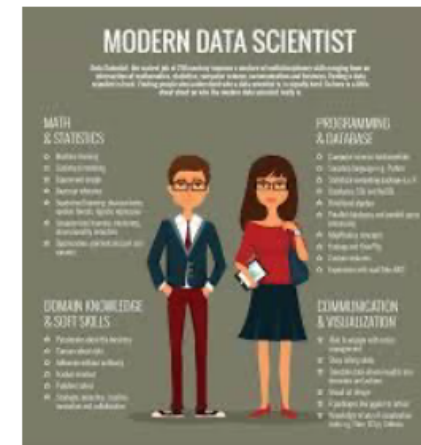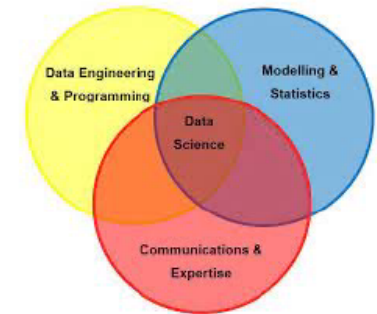
Recommended skills
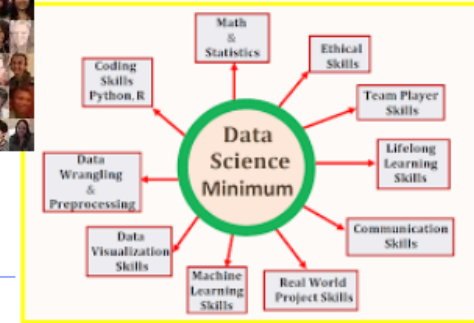
Technical skills

- Statistics
- Multivariable calculus
- Linear algebra
- Machine learning techniques
- Programming/computing
- Data base management

Human skills

- Communication skills
- Critical thinking and logic
- Problem solving
- Team work
- Adaptability and flexibility

Common educational background

A bachelor's degree in data science/statistics or a related field, such as mathematics or computer science.
Best jobs may require a more advanced degree: over 90% of the professionals working in the field have either MS or PhD degree.

TechWise Program at UNR

- A diversity, equity, and inclusion program offered by TalentSprint and supported by Google.

- An **18-month virtual program** offering **technical training, 100% financial assistance** ($4250 stipend) and **1:1 Google mentorship** to students from UNR and 4 other community and undergraduate colleges across the USA. It aims to empower students to become world-class entry-level software engineers / data scientists by the time they graduate college and complete the virtual program.

- Organized and run by:

- **TalentSprint**: Faculty and mentors help you build the required technical skills

- **Google**: 1:1 mentoring from Google helps you evolve as a professional

- **UNR**: Supports you throughout the program

- 1st cohort started March 2022: 30 students from UNR (120 total across 5 colleges)

- 2nd cohort started March 2023: 18 students from UNR (120 total across 8 colleges)

- 3rd cohort started March 2024: 13 students from UNR (110 total across 8 colleges)

TechWise Program at UNR

- Google supports the program:

- Google is committed to creating a diverse and inclusive workforce. They recognize the importance of building inclusive technology cultures that foster engagement, collaboration, and a sense of belonging.

- If students successfully complete the program, they will be offered an interview with Google. Also competitive for jobs in other leading tech companies.

- Internship opportunities available as well.

TechWise Program at UNR

- Structure of program:
  - 3 courses, each 3 months long
  - 3 group projects, each 2-3 months long, oral presentations/demonstrations

- Course 1: Computational thinking, Good programming practice, Python

- Course 2: Web basics, JS, CSS, DOM, DBMS basics, DSA basics, Analysis of performance

- Course 3: Issues of scale, Advanced data structures and algorithms