

Digital Forensics Certification Training for the Department of Homeland Security and State and Local Law Enforcement (FLETC)

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Introduction to Problem

“Cyberattacks are the fastest growing crime in the U.S. and they continue to grow in size and sophistication [1].” The increase in these attacks across the nation has made digital forensics an important component of the criminal justice system. Digital forensics is a branch of forensic science involving the recovery and investigation of data from digital devices. This type of evidence can be very useful for providing vital information during investigations. However, it can be challenging for professionals to manipulate, store, access, and use in courtroom settings. To help avoid these challenges, digital forensics professionals should be properly trained and receive relevant certifications.

Overview of CCICADA and REU CINA Project

- Analyze training and certification requirements for digital forensics for Homeland Security investigative units and State and Local Law Enforcement.
- Work with FLETC to identify opportunities and gaps in digital forensics training.
- Recommend digital forensics training and certification pathways to standardize training and certification across all of Homeland Security.

My Project Goals

- Use data science to analyze qualitative and quantitative data:
 - Subject matter of expert interview reports
 - Qualitative input from technical experts, project partners, researchers
 - Ongoing database of available certifications/classes
 - Employment/labor hiring raw data
 - Practitioner survey data
- Interpret and perform data analysis, continually gathering more data as needed
- Gather insights and present findings to practitioners
- Present at professional venue, to practitioners, and make a national impact on training

NOTE: Only a subset of findings will be included in this presentation. Please contact me with any additional questions.

Research Steps and Datasets Analyzed

Step 1: Completed Literature Review on the following topics:

- Cybersecurity and digital forensics basics
- Data visualization
- Clustering techniques

Step 2: Gather data sets

Step 3: Collect questions to be answered by the CINA research team and formulate other interesting questions about the data

Step 4: Visualize data in Microsoft Excel

Step 5: Interpret results and identify notable discoveries

Step 6: Gather insights from the CINA research team

Step 7: Repeat analysis from data points and answer any additional questions

Labor Analysis in Burning Glass, looked at thousands of relevant job postings/openings and pieces of data over 5–6 years

Industry Certifications and Courses related to Digital Forensics: 186 related courses/certifications found by CINA team

Background Information

Cybersecurity: the practice of protecting systems, networks, and programs from digital attacks [2].

a.k.a
Computer
Forensics

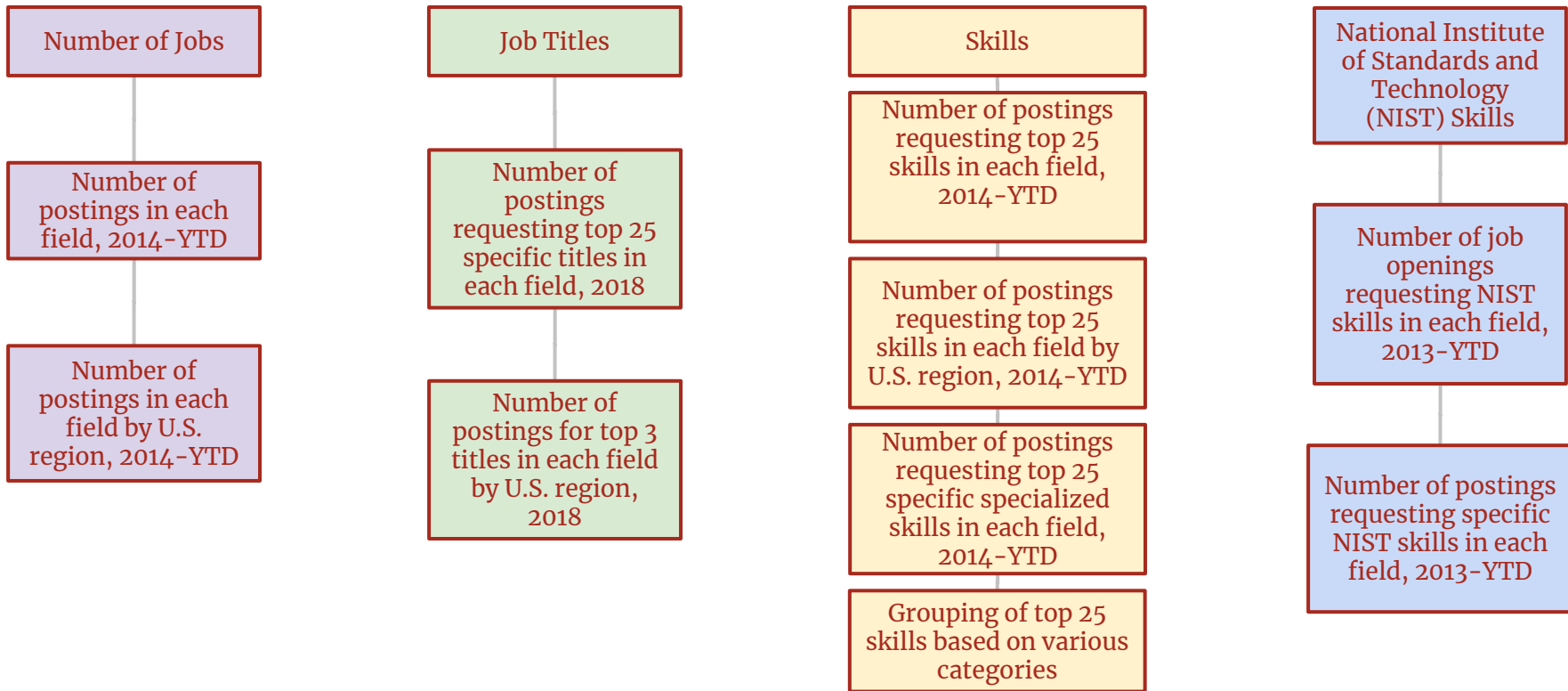
→ **Digital Forensics:** the practice of identifying, preserving, recovering, analyzing and presenting facts about digital evidence found on computers [3].

Computer Forensics: the practice of extracting and preserving data from a computer so that it can be used in a criminal proceeding as evidence [4].

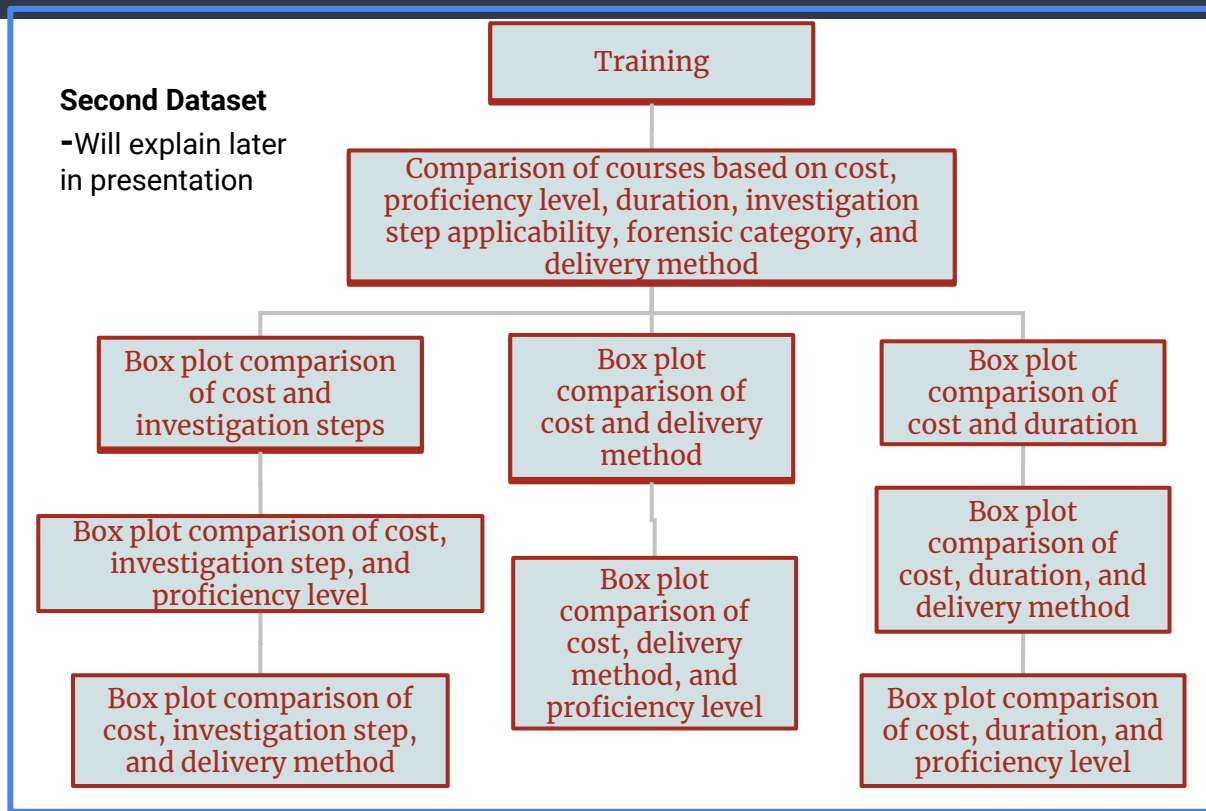
a.k.a
Computer
Forensics

→ **Cyber Forensics:** the practice of gathering, processing, interpreting, and using digital evidence to provide a conclusive description of cyber crime activities [5].

Labor Analysis Graphic



Certification Analysis Graphic



Job Opening Analysis

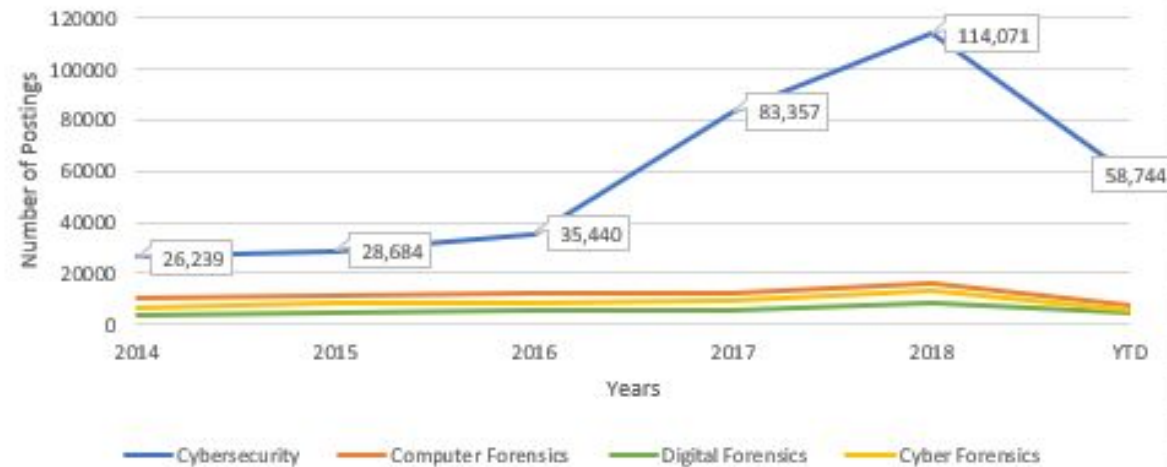
(2014-YTD)

GOAL: Use data science to analyze employment/labor hiring raw data.

Information collected from <https://laborinsight.burning-glass.com/jobs/us#/jobs/loginwindow?returnUrl=jobs%2Flicenseagreement>

- Data is pulled from corporate website's job boards and other places where job ads are posted. **Ex:** Indeed (It scans more than 40,000 sources capturing roughly 85% of all open jobs)
- **NOTE:** Job postings that are missed are typically for small businesses. **Ex:** Restaurant posting a "Help Wanted" sign in the window. Lower income and lower skilled jobs are less likely to be posted online versus higher skilled jobs. However, online postings have expanded.

Number of Job Postings in Each Field Across U.S.

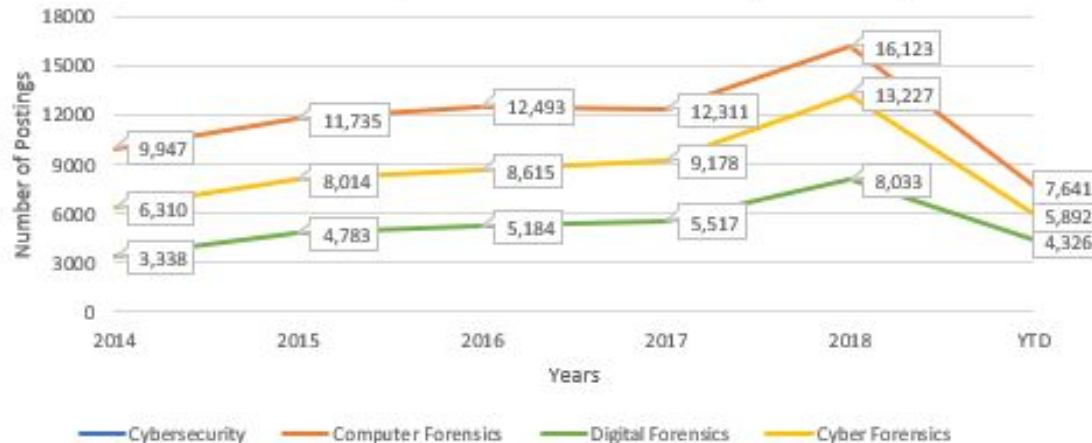


Greatest to Least:

1. Cybersecurity
2. Computer Forensics
3. Cyber Forensics
4. Digital Forensics

The trend lines for computer forensics, digital forensics, and cyber forensics are almost identical. Since the terms are basically interchangeable, this shows which terms employers are using more frequently.

Number of Job Postings in Each Field Across U.S. (Zoomed-In)

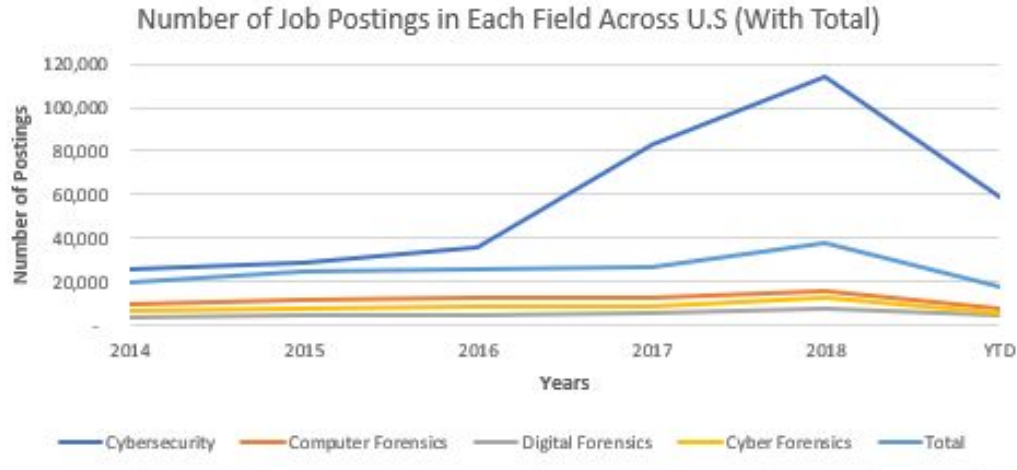


Why is cybersecurity much greater than any other field, especially from 2016 to YTD?

Cybersecurity: Provides protection from cyber attacks **before they happen**. Everyone wants to be protected from cyber breaches, which have been significantly increasing. This means cybersecurity is being used by individuals, businesses, and corporations that has sensitive information. Many companies hire employees that oversee cybersecurity alone [6].

Digital Forensics: Investigate and analyze evidence from cyber crimes **after they happen**. Used by any individual, business, or corporation that has experienced a cyber attack that needs further investigation [3].

Typically Digital, Computer, and Cyber Forensics are a subset of Cybersecurity.



This graph includes a line that combines Computer Forensics, Digital Forensics, and Cyber Forensics.

Certification Analysis

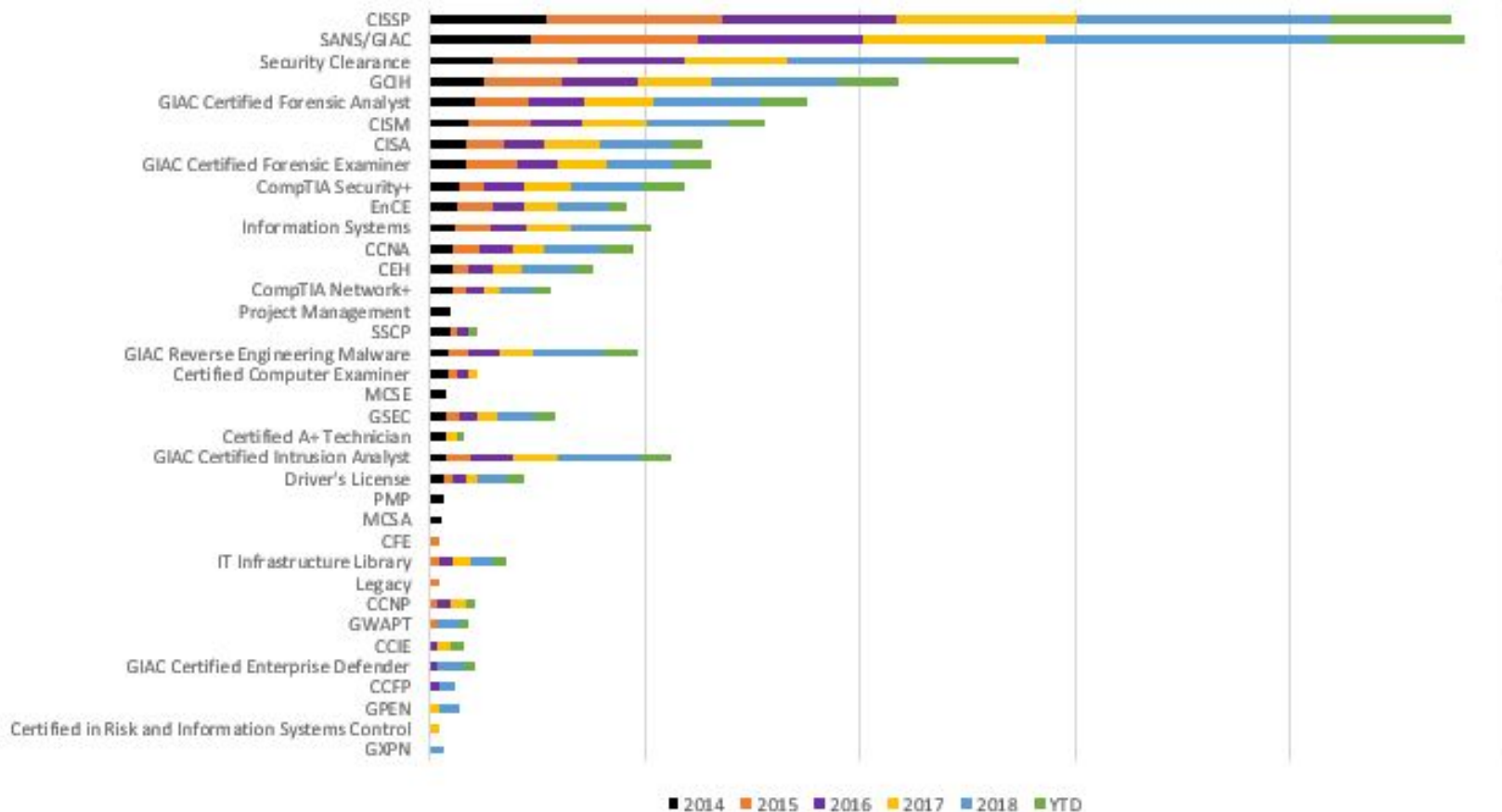
(2014-YTD)

GOAL: Use data science to analyze, compare, and identify any opportunities, gaps, or differences between cybersecurity, computer forensics, digital forensics, and cyber forensics certification requirements.

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Top 25 Certifications In Demand For Digital Forensics Job Openings Each Year Across U.S.



Top 10 Certifications From 2014 to YTD

Cybersecurity

1. Security Clearance
2. CISSP
3. CompTIA Security+
4. SANS/GIAC
5. CISM
6. CISA
7. IT Infrastructure Library
8. Project Management
9. CCNA
10. Information Systems

Computer Forensics

1. CISSP
2. SANS/GIAC
3. Security Clearance
4. GCIH
5. CISM
6. CISA
7. CompTIA Security+
8. GIAC Certified Forensic Analyst
9. GIAC Certified Intrusion Analyst
10. CCNA

Digital Forensics

1. SANS/GIAC
2. CISSP
3. Security Clearance
4. GCIH
5. GIAC Certified Forensic Analyst
6. CISM
7. GIAC Certified Forensic Examiner
8. CISA
9. CompTIA Security+
10. Information Systems

Cyber Forensics

1. CISSP
2. SANS/GIAC
3. Security Clearance
4. GCIH
5. CISM
6. CompTIA Security+
7. CISA
8. GIAC Certified Intrusion Analyst
9. GIAC Certified Forensic Analyst
10. CCNA

Similarities/Differences For Certifications (2014–YTD)

| | Cybersecurity | Computer Forensics | Digital Forensics | Cyber Forensics |
|---------------|--|--|---|--|
| Top 3 | CISSP, CompTIA Security+, Security Clearance | CISSP, SANS/GIAC, Security Clearance | CISSP, SANS/GIAC, Security Clearance | CISSP, SANS/GIAC, Security Clearance |
| Top 10 | CompTIA Security+, CISM, CCNA, CISSP, SANS/GIAC, Security Clearance Information Systems, Project, Management, IT Infrastructure Library | CompTIA Security+, CISM, CCNA, CISSP, SANS/GIAC, Security Clearance, GIAC, Certified Intrusion Analyst | CompTIA Security+, CISM, CCNA, CISSP, SANS/GIAC, Security Clearance, GIAC Certified Intrusion Analyst, Information Systems GIAC Certified Forensic Examiner | CompTIA Security+, CISM, CCNA, CISSP, SANS/GIAC, Security Clearance, GIAC Certified Intrusion Analyst |
| Top 25 | ITIL, CPA, MCSE, CISSP, SANS/GIAC, Security Clearance, CompTIA Security+, Project Management, CISM, IT Infrastructure Library, CISA, CCNA, PMP, Information Systems, SSCP, Driver's License, GSEC, CompTIA Network+, GCIH, CCNP, CEH, Certified in Risk and Information Systems Control, GIAC Certified Intrusion Analyst, CCIE, GIAC Certified Forensic Analyst, Certified A+ Technician, Java, Master Project Management, ABET, GSLC, CASP, MCSA | ITIL, CPA, EnCE, CISSP, SANS/GIAC, Security Clearance, CompTIA Security+, Project Management, CISM, IT Infrastructure Library, CISA, CCNA, PMP, Information Systems, SSCP, Driver's License, GSEC, CompTIA Network+, GCIH, CCNP, CEH, Certified in Risk and Information Systems Control, GIAC Certified Intrusion Analyst, CCIE, GIAC Certified Forensic Analyst, Certified A+ Technician, Certified Forensic Examiner, GIAC Reverse Engineering Malware, CFE, GIAC Certified Enterprise Defender, GPEN, Cisco Certified Security Professional | MCSE, CCFP, CISSP, SANS/GIAC, Security Clearance, CompTIA Security+, Project Management, CISM, IT Infrastructure Library, CISA, CCNA, PMP, Information Systems SSCP, Driver's License, GSEC, CompTIA Network+, GCIH, CCNP, CEH, Certified in Risk and Information Systems Control, GIAC Certified Intrusion Analyst, CCIE, GIAC Certified Forensic Analyst, Certified Computer Examiner, GXPN, Certified A+ Technician Certified Forensic Examiner, GIAC Reverse Engineering Malware, CFE, GIAC Certified Enterprise Defender, GPEN, MCSA | EnCE, CCFP, CISSP, SANS/GIAC, Security Clearance, CompTIA Security+, Project Management, CISM, IT Infrastructure Library, CISA, CCNA, PMP, Information Systems, SSCP, Driver's License, GSEC, CompTIA Network+, GCIH, CCNP, CEH, Certified in Risk and Information Systems Control, GIAC Certified Intrusion Analyst, CCIE, GIAC Certified Forensic Analyst, Certified Forensic Examiner, GIAC Reverse Engineering Malware, CFE, GIAC Certified Enterprise Defender, GPEN, MCSA, GWAPT |

Groupings of Top 25 Employer Requested Certifications

| Management | Security/ Defense | Background Checks | Network | Computer Software | IT | Investigation | Testing | Law |
|---|--|---|--|---|--|--|---|---|
| <ul style="list-style-type: none"> • Project Management • CISM • IT Infrastructure Library • PMP • Master Project Management • GSLC | <ul style="list-style-type: none"> • CISSP • CompTIA Security+ • SANS/GIAC • SSCP • GSEC • CEH • GIAC Certified Intrusion Analyst • CASP • GIAC Certified Forensic Analyst • GCIH • GIAC Reverse Engineering Malware • CFE • GIAC Certified Enterprise Defender | <ul style="list-style-type: none"> • Drivers License • Security Clearance | <ul style="list-style-type: none"> • CompTIA Network+ • CCNP | <ul style="list-style-type: none"> • MCSE • MCSA • Java • MCSE (Legacy) | <ul style="list-style-type: none"> • CCNA • Information Systems • ITIL • Certified A+ Tech. • CRISC • CCIE • CISA • ABET • CCSP • GPEN • CCNP | <ul style="list-style-type: none"> • ENCE • GIAC Certified Forensic Examiner | <ul style="list-style-type: none"> • GWAPT • GXPN | <ul style="list-style-type: none"> • CCFP • CCE |

Other: CPA

NOTE: Skills in red mean they could fit into multiple categories.

Specialized Skills Analysis

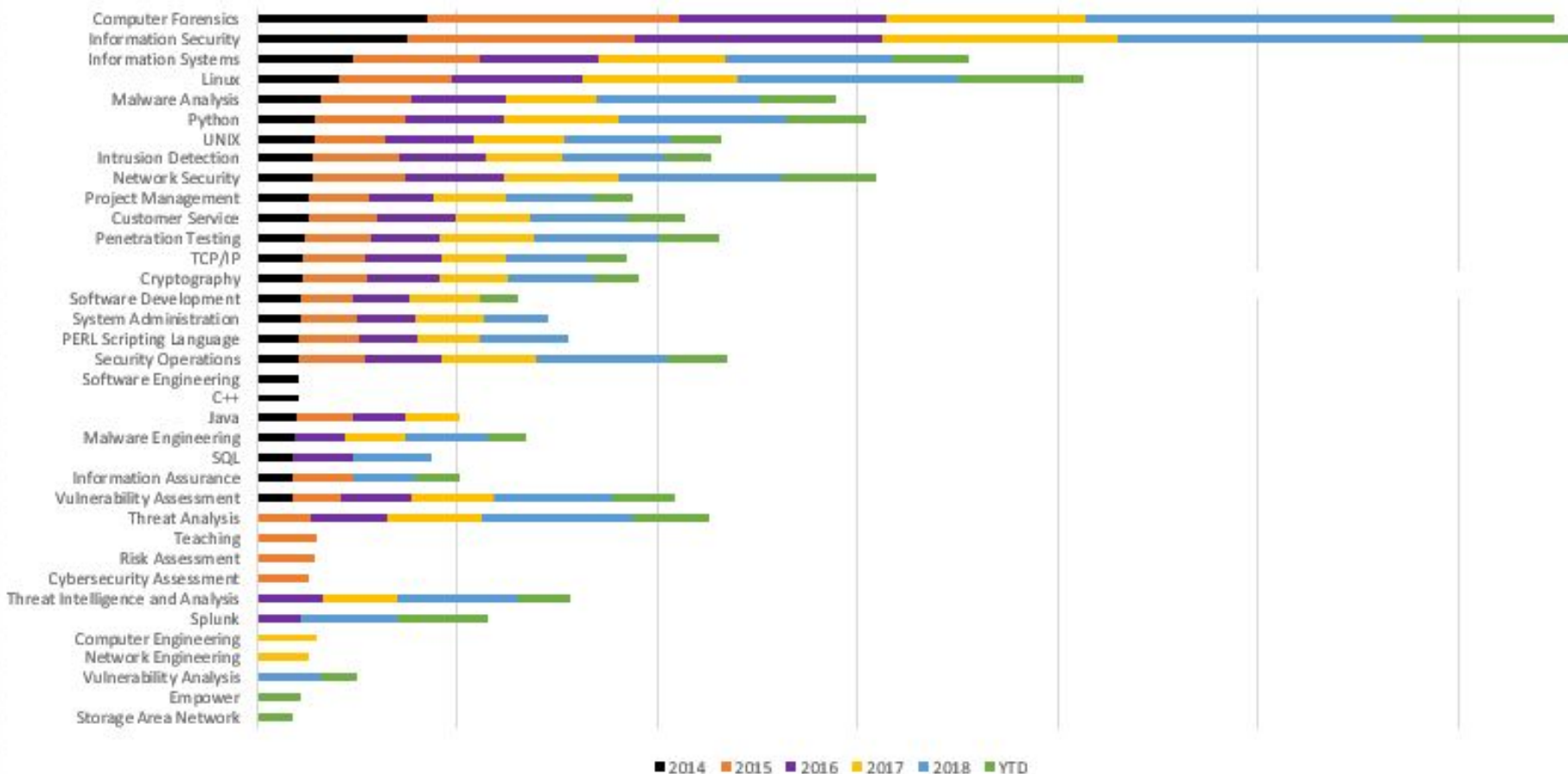
(2014-YTD)

GOAL: Use data science to analyze, compare, and identify any opportunities, gaps, or differences between cybersecurity, computer forensics, digital forensics, and cyber forensics specialized/NIST skill requirements.

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Top 25 Skills In Demand For Digital Forensics Job Openings Each Year Across U.S.



Top 10 Skills From 2014 to YTD

Cybersecurity

1. Information Security
2. Information Systems
3. Linux
4. Project Management
5. Software Development
6. Systems Engineering
7. NIST Cybersecurity Framework
8. Java
9. Customer Service
10. Information Assurance
11. Python

Computer Forensics

1. Computer Forensics
2. Information Security
3. Linux
4. Information Systems
5. Network Security
6. Python
7. Malware Analysis
8. Intrusion Detection
9. Unix
10. Penetration Testing

Digital Forensics

1. Information Security
2. Computer Forensics
3. Linux
4. Information Systems
5. Network Security
6. Python
7. Malware Analysis
8. Security Operations
9. Unix
10. Penetration Testing

Cyber Forensics

1. Information Security
2. Computer Forensics
3. Linux
4. Malware Analysis
5. Information Systems
6. Network Security
7. Intrusion Detection
8. Threat Analysis
9. Security Operations
10. Python

Similarities/Differences For Skills (2014-YTD)

| | Cybersecurity | Computer Forensics | Digital Forensics | Cyber Forensics |
|---------------|--|--|---|--|
| Top 3 | Information Security, Information Systems, Linux | Information Security, Computer Forensics, Linux | Information Security, Computer Forensics, Linux | Information Security, Computer Forensics, Linux |
| Top 10 | Information Security, Information Systems, Linux, Python, Project Management, Software Development, Systems Engineering, NIST Cybersecurity Framework, Java, Customer Service, Information Assurance | Information Security, Information Systems, Linux, Python, Malware Analysis, Intrusion Detection, Penetration Testing, Unix, | Information Security, Information Systems, Linux, Python, Malware Analysis, Intrusion Detection, Penetration Testing, Unix, Security Operations | Information Security, Information Systems, Linux, Python, Malware Analysis, Intrusion Detection, Security Operations, Threat Analysis |
| Top 25 | Scheduling, Cybersecurity Assessment, Information Security, Information Systems, Linux, Project Management, Unix, Java, Customer Service, Information Assurance, C++, Computer Engineering, System Administration, Network Security, Python, Cryptography, Intrusion Detection, Vulnerability Assessment, Network Engineering, Splunk, Software Development, SQL, Budgeting, Systems Engineering, Oracle, JavaScript, Customer Contact, Technical Support, SAP, Technical Writing/Editing, Simulation, Business Process, Risk Management, Risk Management Framework, Cybersecurity Knowledge, Sales, Software Engineering, CISCO, Nist Cybersecurity Framework | Information Security, Information Systems, Linux, Project Management, Unix, Java, Customer Service, Information Assurance, C++, Computer Engineering, System Administration, Network Security, Python, Cryptography, Intrusion Detection, Vulnerability Assessment, Network Engineering, Splunk, Software Development, SQL, CISCO, Nist Cybersecurity Framework, Computer Forensics, Malware Analysis, Penetration Testing, Security Operations, PERL Scripting Language, TCP/IP, Threat Analysis, Vulnerability Analysis, Threat Intelligence and Analysis, Malware Engineering, Litigation | Cybersecurity Assessment, Risk Assessment, Information Security, Information Systems, Linux, Project Management, Unix, Java, Customer Service, Information Assurance, C++, Computer Engineering, System Administration, Network Security, Python, Cryptography, Intrusion Detection, Vulnerability Assessment, Network Engineering, Splunk, Software Development, SQL, Software Engineering, Computer Forensics, Malware Analysis, Penetration Testing, Security Operations, PERL Scripting Language, TCP/IP, Threat Analysis, Vulnerability Analysis, Threat Intelligence and Analysis, Malware Engineering, Teaching, Empower, Storage Area Network | Scheduling, Risk Assessment, Information Security, Information Systems, Linux, Project Management, Unix, Java, Customer Service, Information Assurance, C++, Computer Engineering, System Administration, Network Security, Python, Cryptography, Intrusion Detection, Vulnerability Assessment, Network Engineering, Splunk, Software Engineering, CISCO, Nist Cybersecurity Framework, Computer Forensics, Malware Analysis, Penetration Testing, Security Operations, PERL Scripting Language, TCP/IP, Threat Analysis, Vulnerability Analysis, Threat Intelligence and Analysis, Malware Engineering, Microsoft Powershell |

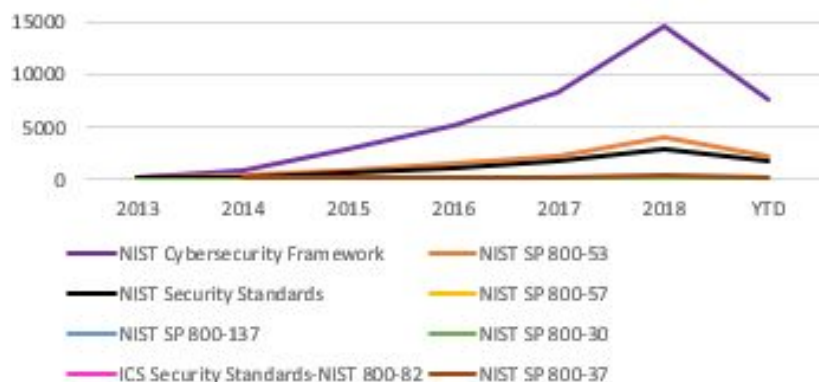
Groupings of Top 25 Employer Requested Skills

| Computer Programming Languages | Soft Skills | Software | Management | Technology | Security/Defense | Law |
|---|---|--|---|--|--|--|
| <ul style="list-style-type: none"> • Java • SQL • JavaScript • C++ • Python • PERL • Microsoft: PowerShell | <ul style="list-style-type: none"> • Scheduling • Budgeting • Customer Service • Customer Contact • Technical Writing/Editing • Simulation • Business Processes • Sales • Teaching | <ul style="list-style-type: none"> • Software Development • Software Engineering • SAP • Splunk • Empower | <ul style="list-style-type: none"> • Project Management • Risk Management | <ul style="list-style-type: none"> • Information Systems • Systems Engineering • Linux • UNIX • Oracle • Information Assurance • System Administration • Technical Support • Computer Engineering • CISCO • Network Engineering • TCP/IP • Storage Area Network | <ul style="list-style-type: none"> • Computer Forensics • Information Security • Network Security • NIST • Cryptography • Vulnerability Assessment • Intrusion Detection • Risk Management Framework • Cybersecurity Knowledge • Cybersecurity Assessment • Malware Analysis • Penetration Testing • Security Operations • Threat Analysis • Vulnerability Analysis • Threat Intelligence & Analysis • Malware Engineering • Risk Assessment • Cybersecurity Assessment | <ul style="list-style-type: none"> • Litigation |

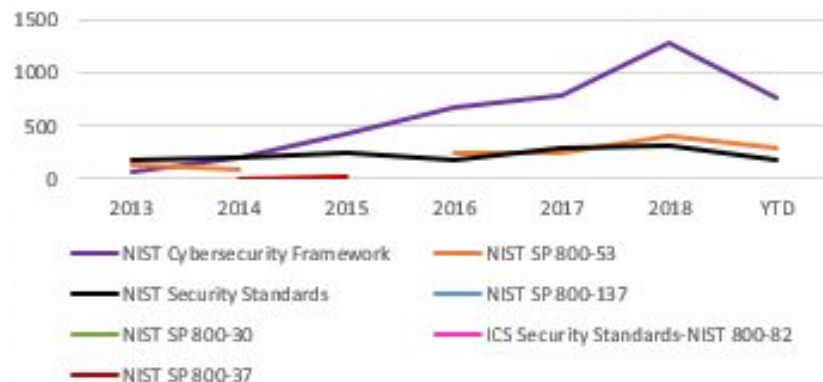
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NIST COMPARISON SUMMARY

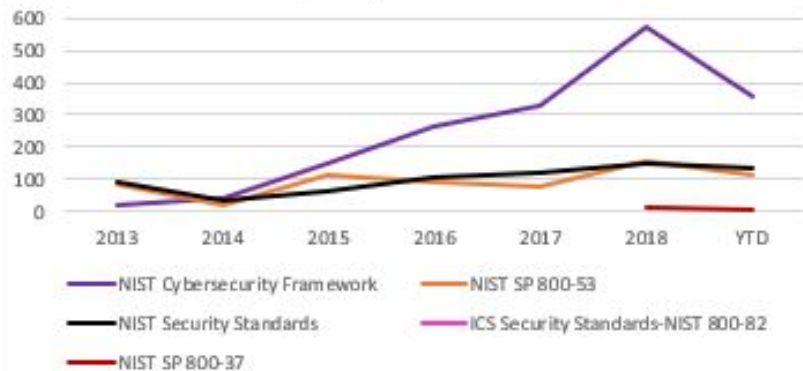
NIST Skill Demand For Cybersecurity Job Openings Across U.S.



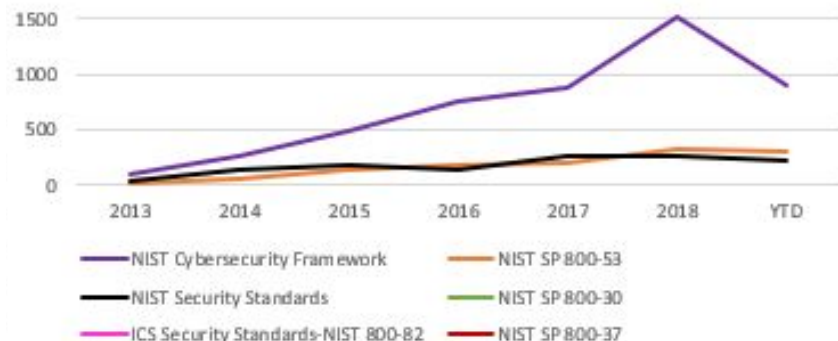
NIST Skill Demand For Computer Forensics Job Openings Across U.S.



NIST Skill Demand For Digital forensics Job Openings Across U.S.



NIST Skill Demand For Cyber Forensics Job Openings Across U.S.



Job Title Analysis

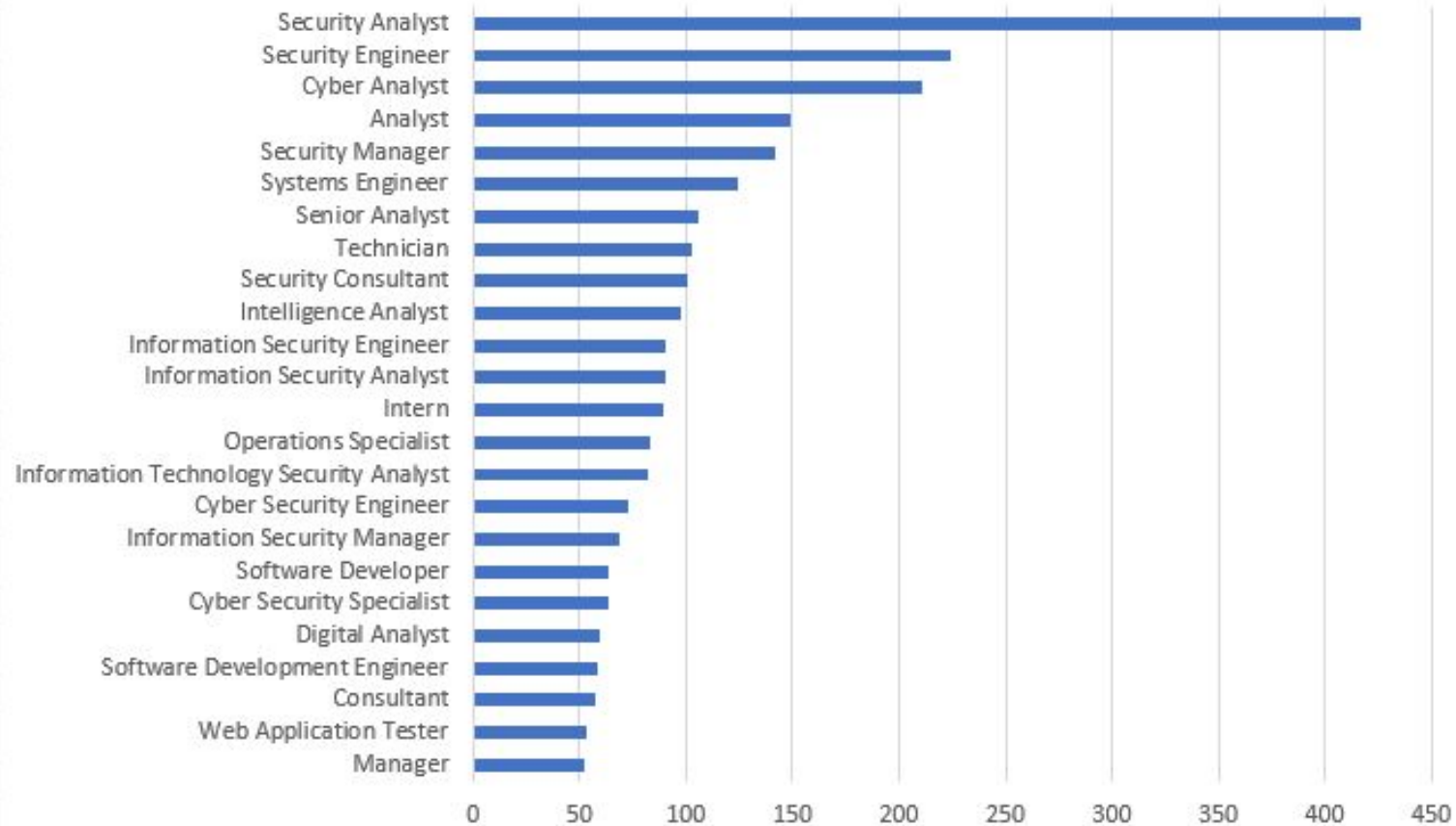
(2018)

GOAL: Use data science to analyze, compare, and identify any differences between cybersecurity, computer forensics, digital forensics, and cyber forensics job titles.

Information collected from <https://laborinsight.burning-glass.com/jobs/us#/jobs/loginwindow?returnUrl=jobs%2Flicenseagreement>

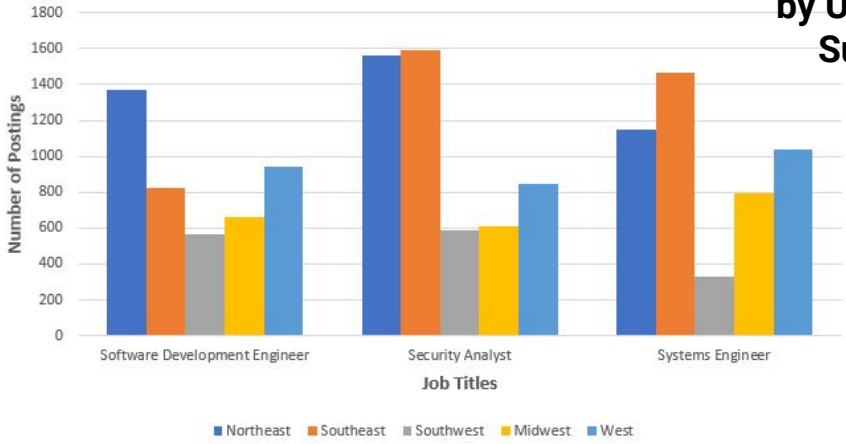
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- **NOTE:** Job postings that are missed are typically for small businesses. **Ex:** Restaurant posting a "Help Wanted" sign in the window. Lower income and lower skilled jobs are less likely to be posted online versus higher skilled jobs. However, online postings have expanded.

Top 25 Digital Forensics Job Titles in 2018

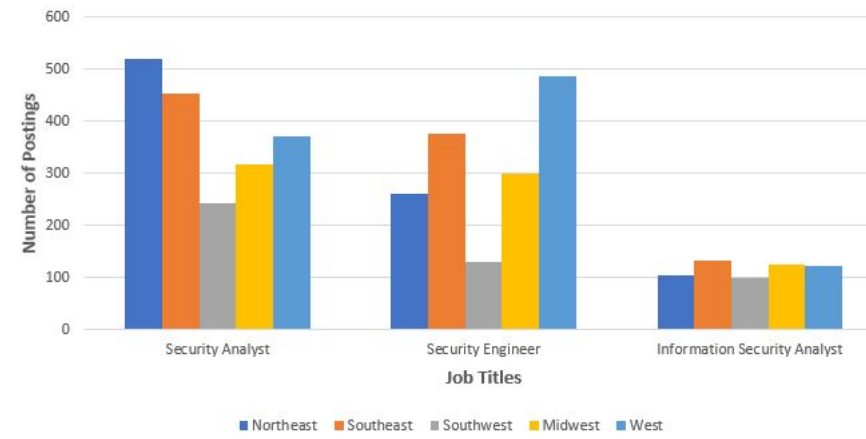


Top 3 Job Titles by U.S. Region Summary

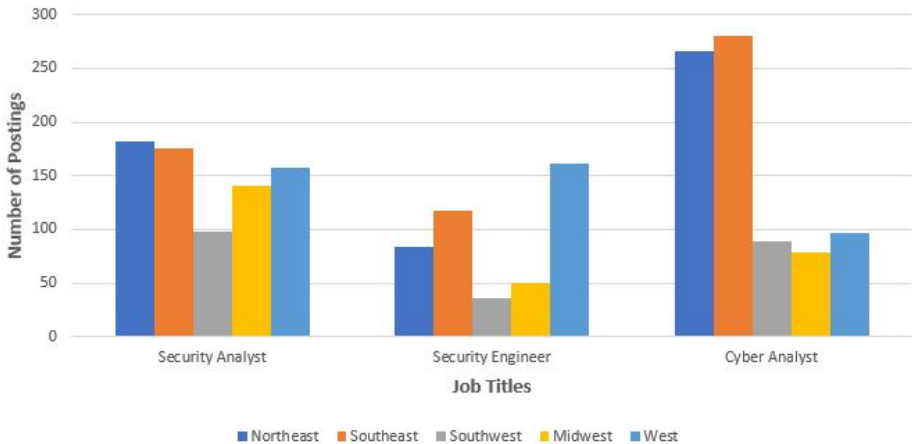
Number of Postings For The Top 3 Cybersecurity Job Titles by U.S. Region in 2018



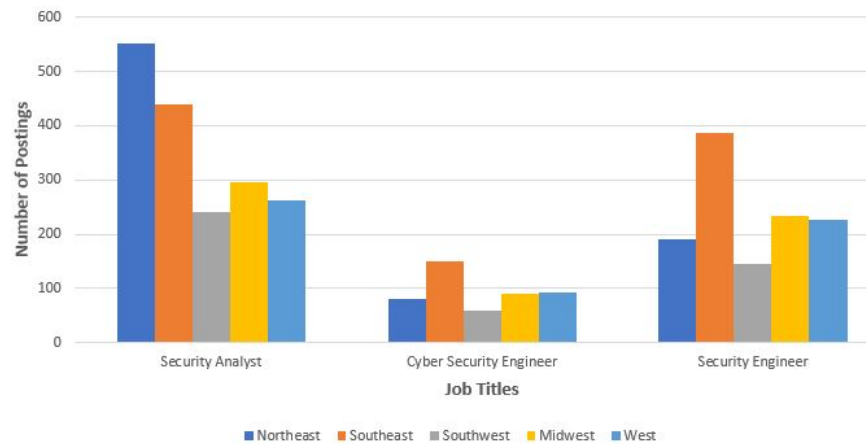
Number of Postings For The Top 3 Computer Forensics Job Titles by U.S. Region in 2018



Number of Postings For The Top 3 Digital Forensics Job Titles by U.S. Region in 2018



Number of Postings For The Top 3 Cyber Forensics Job Titles by U.S. Regions in 2018



Top 3 Job Titles in 2018

Cybersecurity

1. Software Development Engineer
2. Security Analyst
3. Systems Engineer

Computer Forensics

1. Security Analyst
2. Security Engineer
3. Information Security Analyst

Digital Forensics

1. Security Analyst
2. Security Engineer
3. Cyber Analyst

Cyber Forensics

1. Security Analyst
2. Cyber Security Engineer
3. Security Engineer

Top 10 Job Titles in 2018

Cybersecurity

1. Software Development Engineer
2. Security Analyst
3. Systems Engineer
4. Security Engineer
5. Security Manager
6. Cyber Security Engineer
7. Intern
8. Systems Administrator
9. Network Engineer
10. Information Technology Specialist

Computer Forensics

1. Security Analyst
2. Security Engineer
3. Information Security Analyst
4. Cyber Analyst
5. Analyst
6. Cyber Security Engineer
7. Information Security Engineer
8. Intern
9. Security Manager
10. Security Architect

Digital Forensics

1. Security Analyst
2. Security Engineer
3. Cyber Analyst
4. Analyst
5. Security Manager
6. Systems Engineer
7. Senior Analyst
8. Technician
9. Security Consultant
10. Intelligence Analyst

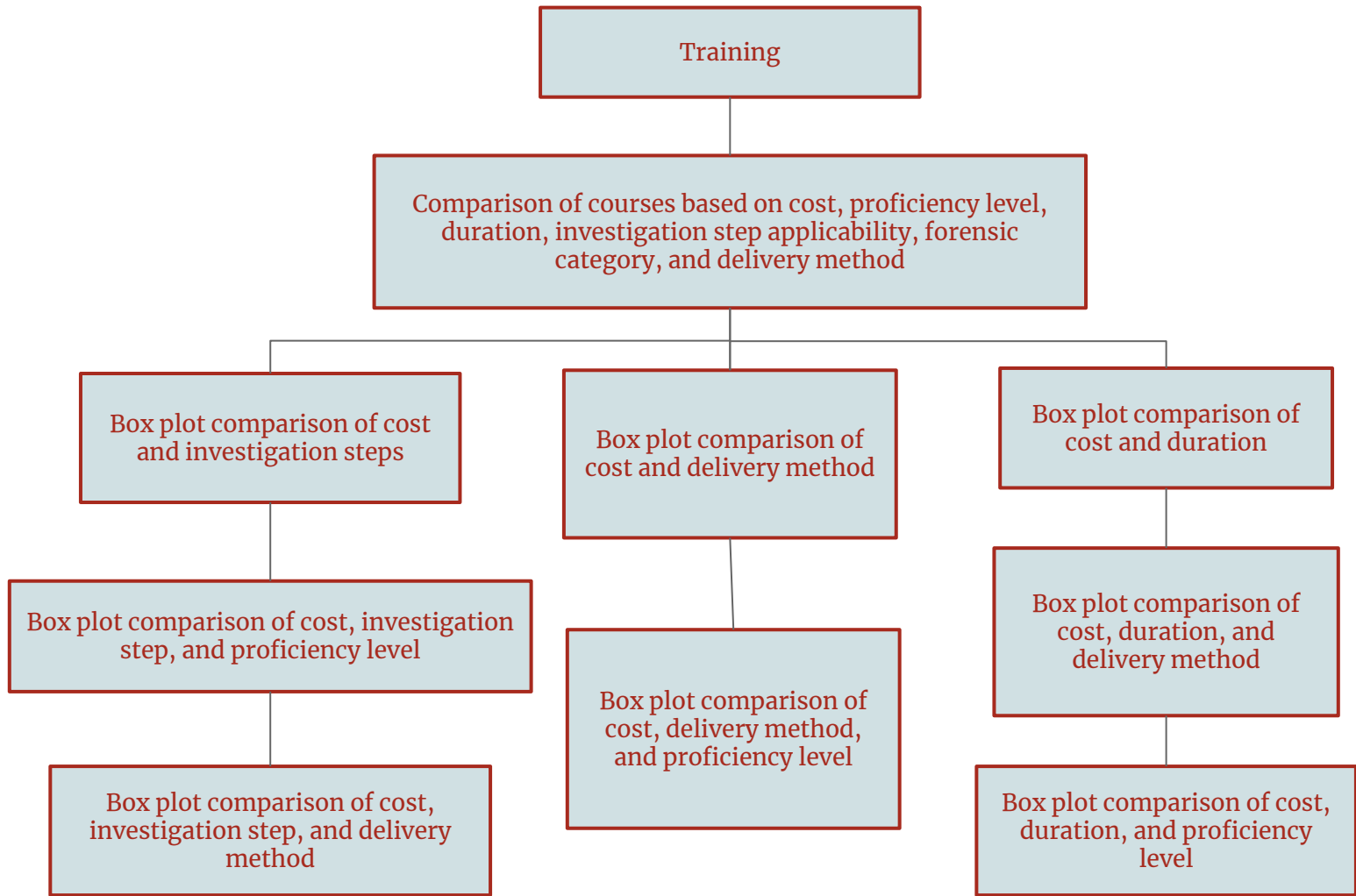
Cyber Forensics

1. Security Analyst
2. Cyber Security Engineer
3. Security Engineer
4. Cyber Analyst
5. Cyber Security Specialist
6. Analyst
7. Security Manager
8. Information Security Engineer
9. Security Consultant
10. Information Security Analyst

Digital Forensics Training Analysis (YTD)

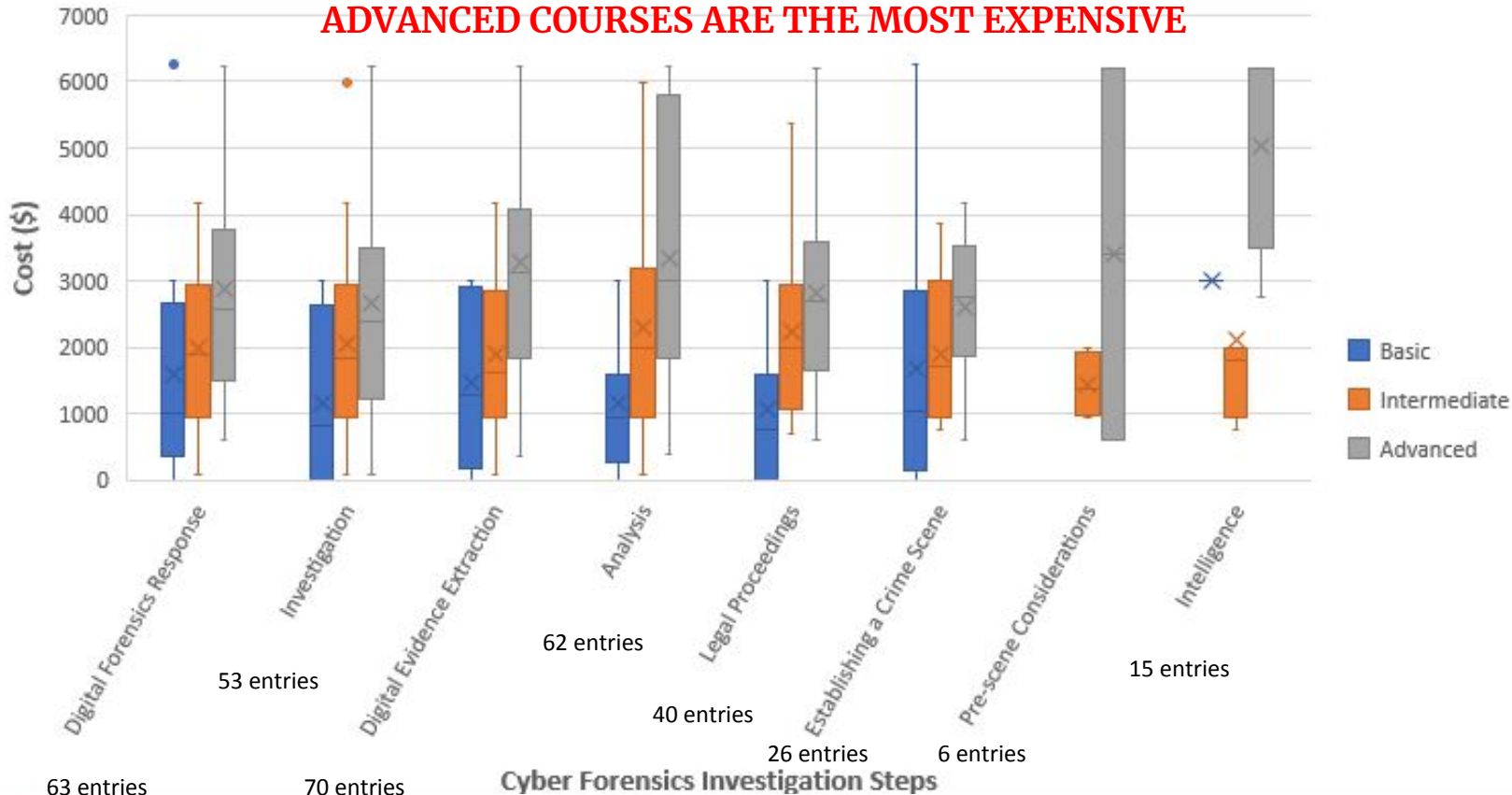
GOAL: Use data science to recommend and standardize training and certification pathways by analyzing the ongoing database of available courses in order to identify any opportunities, gaps, or differences between cybersecurity, computer forensics, digital forensics, and cyber forensics training.

Information collected from the Excel spreadsheet titled, “Digital Forensics Training Database.”



Digital Forensics Training Cost vs. Cyber Forensics Investigation Step Applicability vs. Proficiency Level

ADVANCED COURSES ARE THE MOST EXPENSIVE

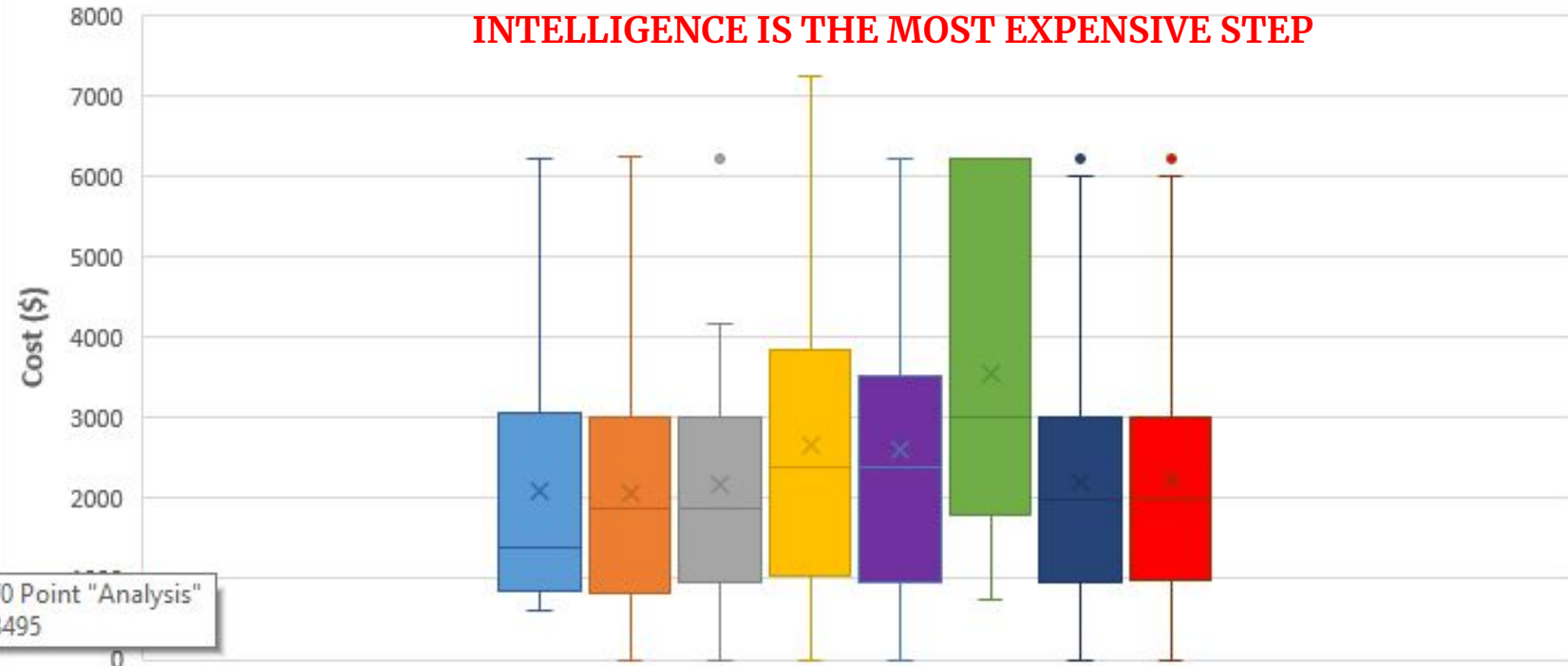


NOTE: 98 courses and 335 entries were used to create this graph since courses without a cost, courses without at least one of the 8 investigation steps, and courses without a proficiency level were not used. Also, for courses that had a price range rather than an exact price, the start and end values of the range were used. **Ex:** If the price range for a course was \$1,000-\$2,500, then \$1,000 and 2,500 were used.

Basic: 63 entries Intermediate: 133 entries Advanced: 139 entries

Digital Forensics Training Cost vs. Cyber Forensics Investigation Step Applicability

INTELLIGENCE IS THE MOST EXPENSIVE STEP



NOTE: 103 courses and 342 entries were used to create this graph since courses without a cost and courses without at least one of the 8 investigation steps were not used. Also, for courses that had a price range rather than an exact price, the start and end values of the range were used. **Ex:** If the price range for a course was \$1,000-\$2,500, then \$1,000 and 2,500 were used.

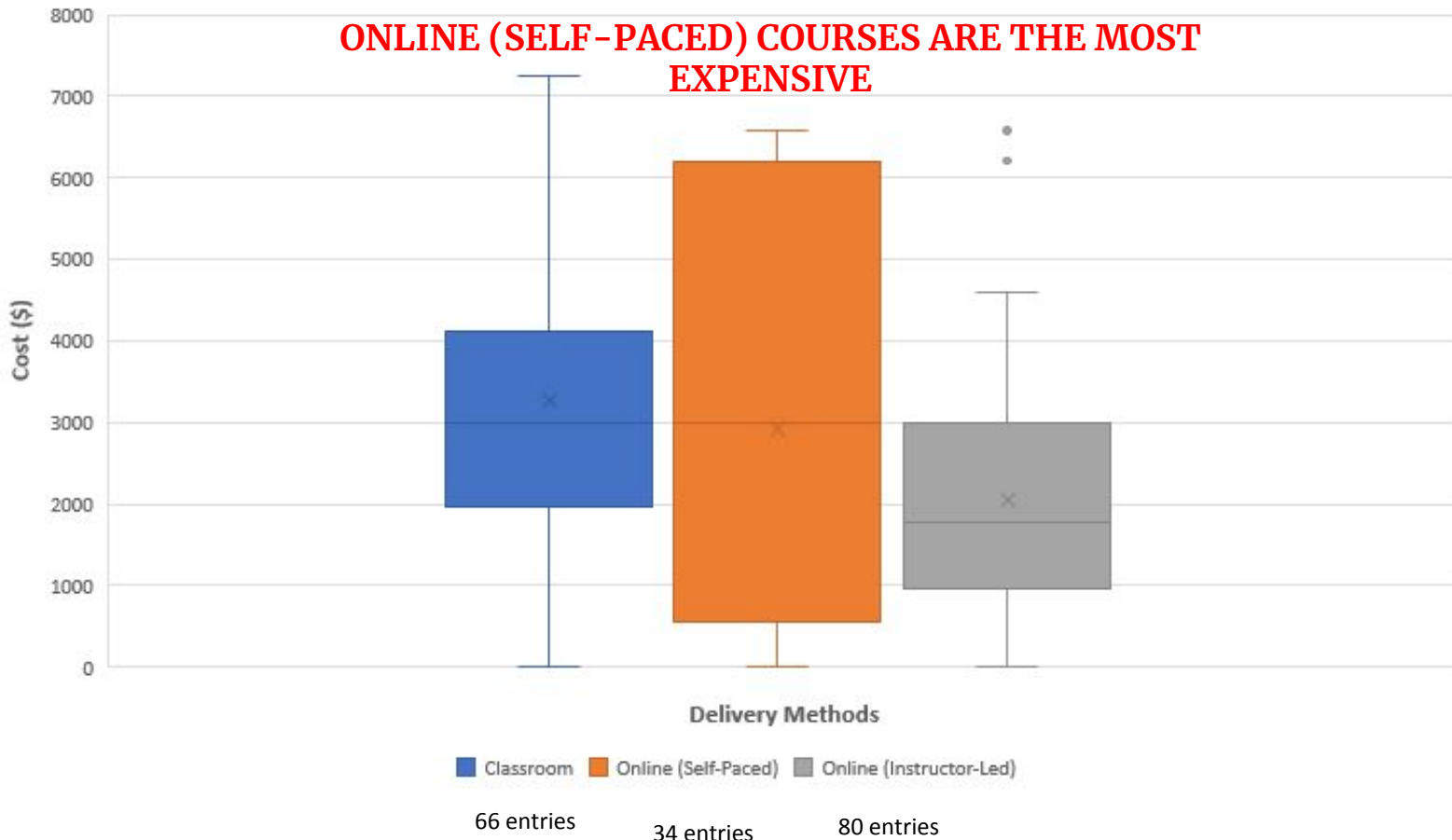
0 Point "Analysis"
495

Cyber Forensics Investigation Steps

- 6 entries
Pre-scene Considerations
- 26 entries
Establishing a Crime Scene
- 63 entries
Digital Forensics Response
- 75 entries
Digital Evidence Extraction
- 64 entries
Analysis
- 15 entries
Intelligence
- 53 entries
Investigation
- 40 entries
Legal Proceedings

Digital Forensics Training Cost vs. Delivery Method

ONLINE (SELF-PACED) COURSES ARE THE MOST EXPENSIVE

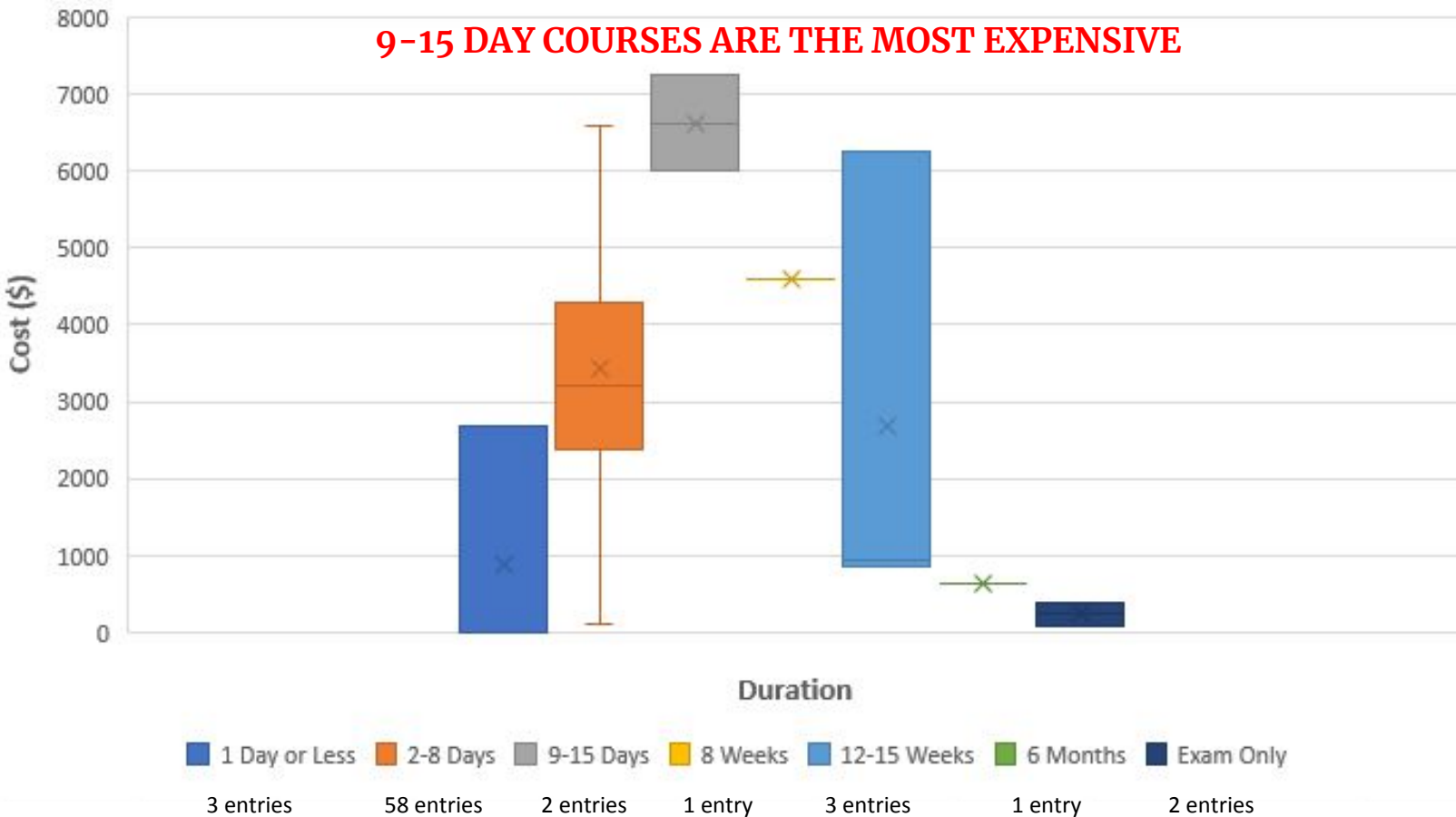


NOTE: 117 courses and 179 entries were used to create this graph since courses without a cost and courses without at least one of the 8 investigation steps were not used. Also, for courses that had a price range rather than an exact price, the start and end values of the range were used. **Ex:** If the price range for a course was \$1,000-\$2,500, then \$1,000 and 2,500 were used.

Digital Forensics Training Cost vs. Duration

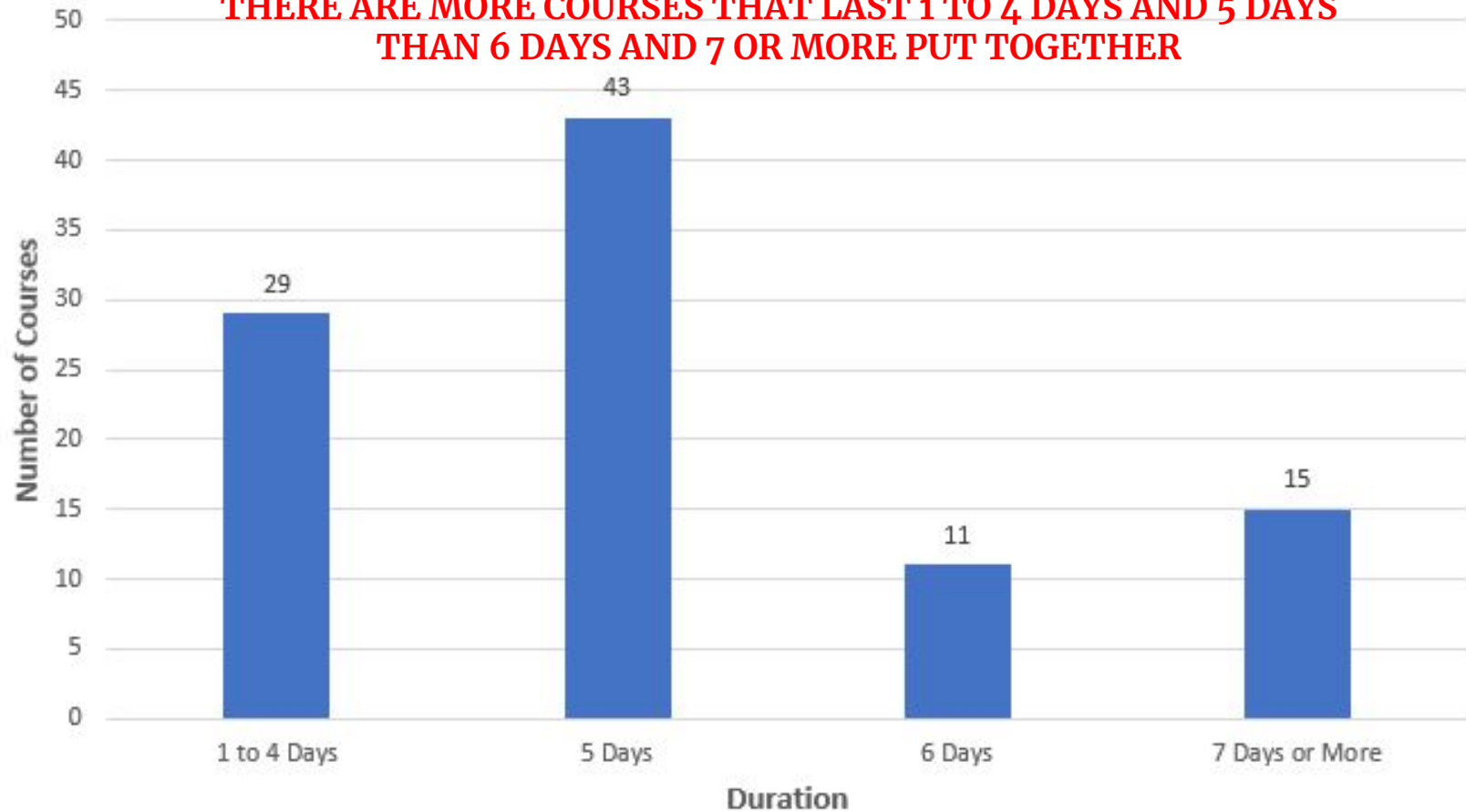
9-15 DAY COURSES ARE THE MOST EXPENSIVE

NOTE: 66 courses and 70 entries were used to create this graph since courses without a cost and courses without a duration were not used. Also, each duration option for every class was used. Also, for courses that had a price range rather than an exact price, the start and end values of the range were used. **Ex:** If the price range for a course was \$1,000-\$2,500, then \$1,000 and 2,500 were used.



Digital Forensics Training Duration

THERE ARE MORE COURSES THAT LAST 1 TO 4 DAYS AND 5 DAYS THAN 6 DAYS AND 7 OR MORE PUT TOGETHER



What's Next?

More Research and Analysis:

- Analyze the # of job postings for the top 3 job titles by requested skills and certifications.
- Complete year to year trend analysis of job titles for the last 5 years by popularity and title similarities. Then determine which titles are part of the public sector (policing, government, homeland security, secret service, dept of defense, etc) and do trend analysis of them as well.
- Analyze course outlines and use a software program to cluster any commonalities between them. Also, determine if the courses cover NIST Special Publications, NIST Security Standards, or NIST Cybersecurity Framework

Conclusion

This is an ongoing project, but I hope the research I have done and continue to do will contribute to the CINA project team's research regarding the certification and training requirements for the Department of Homeland Security and State and Local Law enforcement for the Federal Law Enforcement Training Center (FLETC).

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