In this issue:

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The COVID-19 Pandemic's Impact on Information Technology Employment, Salaries, and Career Opportunities

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Abstract

This is a an empirical study of the effect of the COVID-19 pandemic on salary and employment trends in Information technology (IT) jobs over the period January 2019 to April 2021. The study is an effort to determine the impact of COVID on IT jobs and salary. Data was extracted from Burning Glass Labor Insight which includes over 40 million US job postings per year. We downloaded monthly data for the time period Jan 2020 to April 2021. These data included all job postings as well as job postings in science, engineering, information technology. They were analyzed using SPSS 26 and Microsoft Excel. We attempted to determine through correlation the degree of similarity between IT jobs and other technical and non-technical work. We gain key insights into IT jobs during the pandemic compared to other STEM jobs as well as variances among IT positions.

Keywords: Information Technology, COVID, COVID-19, IT jobs, pandemic

1. INTRODUCTION

The COVID-19 pandemic took a toll on workers across the globe. Social distancing and mask wearing became the norm. People were separated not only from their workplaces, but also from their loved ones. There was disruption across all industries with business closures and work-from-home (WFH) mandates. Women and under-represented populations took the hardest hit with increased domestic responsibilities for children and elders. The Information Technology sector was not immune to the disruption. While there was a need for new technologies, for example Zoom, to support learning and working from home, the tech industry also took a hit when it came to total job postings. This paper analyzes over 40 million job postings on Burning Glass Labor Insights during the period January 2019 to April 2021. The authors conclude that there will continue to be a need for tech workers especially in cybersecurity, software development and artificial intelligence. Tech workers will have to continue to learn new skills in order to keep up with the demands of the post-COVID economy.

2. LITERATURE REVIEW

The COVID-19 pandemic has brought about the greatest economic disruption since the Great Depression and job postings by American companies have been dramatically altered by the pandemic (Campello, Kankanhalli, Muthukrishnan, 2020). The authors analyzed data from LinkUp, a leading labor market research firm. Figure 1. shows an irregular drop in job postings at the beginning of the pandemic in March 2020. This drop also coincides with an extraordinary spike in initial jobless claims.
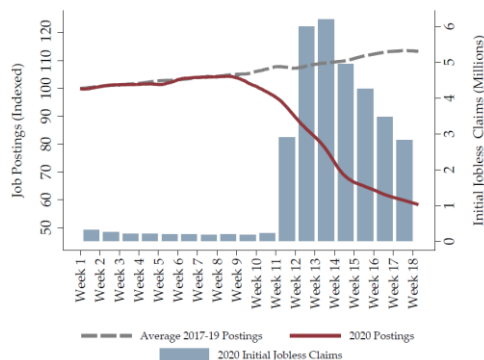

Figure 1. Job postings vs. unemployment claims

The McKinsey Global Institute discusses the future of work after COVID-19. They cite work trends that have increased by the pandemic (Lund, et al, 2021, pg. vii). They are:

1. Remote Work--20-25% of workers in advanced economies could work remotely 3+ days a week on a long-term basis
2. Digitization--2-5x growth in e-commerce, as a surge in digital platforms is underway
3. Automation—An uptick in use of robotics, robotic process automation and AI

Remote work has been supported by new digital solutions, such as "videoconferencing, document sharing tools, and expansion of cloud-based computing capacity" (Lund, et al, pg. 5).

Internet of Things (IoT) technologies provided "mechanical and digital technologies to transfer the data through the Internet without any human interaction." (Javaid & Khan 2021, pg. 209). IoT enabled healthcare workers to interact with and diagnose patients remotely; it opened new doors for medical professionals in the ways that they or their patients could never have imagined.

The COVID-19 pandemic also magnified structural inequalities such as class and ethnicity. In addition, there was a surge in cyberbullying and racial discrimination of Asian people (Zheng & Walsham, 2021). Lockdown has sadly increased the occurrences of domestic violence against women and children (Roy, 2021). In addition, queer people have found inequality during the pandemic given the "heteronormative" IT industry that often makes special allowances for men and women in heterosexual unions, but not for queer people (Roy, 2021).

How did women in tech, specifically, fare during the pandemic? According to Landry (2021), half of the women surveyed working in technology believe the "effects of COVID-19 have delayed their career progression, despite a similar percentage believing that much needed gender equality is more likely to be achieved through remote working structures" (para 1). Almost half of the women surveyed who were employed in technology struggled to balance work and family life since March 2020.

However, Greszler (2021) asserts this is no longer the case. COVID-19 initially disproportionately affected women because they lost more jobs and were more likely to stay at home.

The IT industry and employee compensation has changed due to the COVID-19 pandemic. As employees are working increasingly remotely and are leaving urban areas, employers are looking at different salary strategies. For example, Zuckerberg revealed that Facebook Inc. employees who work remotely and elect to move will be paid based on their new location. Many other firms, including Box, Inc., and Slack Technologies are investing similar strategies (Melin & Grant, 2020).

The number of jobs in the US IT market appears to have recovered those jobs that were lost due to COVID-19 (Gruman, 2021) According to the Bureau of Labor and Statistics at the end of 2020 there were 33,200 IT jobs in the US.

Dice.com, a leading database firm for IT employees, analyzed more than 6 million job tech job postings in the US during the first 4 months of 2020 (Bhalerao, 2020). In its 2020 Tech Job report, the company cited the top 15 tech jobs during that period for which companies were hiring. They were:
1. Software Developer
2. Network Engineer
3. Systems Engineer
4. Senior Software Developer
5. Java Developer
6. Software QA Engineer
7. IT Project Manager
8. Application Developer
9. Computer Support Specialist
10. Business Analyst
11. Computer Programmer
12. Systems Administrator
13. Graphic Designer
14. Cybersecurity Engineer
15. DevOps Engineer

Bhalerao (2020) argues that many employers were de-prioritizing new projects during the pandemic to "focus their efforts on their core product offerings and infrastructure maintenance." (para 5).

According to the Tech Salary report by Dice.com (2021), overall technologist salaries in the US increased by 3.6% between 2019 and 2020, averaging $97,859. The report indicated that the fastest growing salaries in tech were in the areas of cybersecurity, data scientist, DevOps Engineer, Tech Support Engineer, and Cloud Engineer. Table 1 shows the salaries and changes in the salaries for occupations in the IT field. The report also investigated the salary change of IT Professionals. In 2020, 52% received a salary increase, 35% experienced no

change and 13% experienced a salary decrease. An item worth noting was the 40% of the people surveyed indicated that their potential salary increase was put on hold during the COVID-19 pandemic.

OCCUPATION	2020	YEAR/YEAR CHANGE
IT Management CEO, CIO, CTO, VP, Dir.	$143,416	▼ 1.7%
Systems Architect	$140,658	▲ 1.7%
Cloud Engineer	$136,479	▲ 6.3%
Cybersecurity Engineer	$134,340	▲ 4.3%
Data Architect*	$133,064	▲ 3.2%
Program Manager	$122,818	– N/A
Management Consultant	$121,619	– N/A
Product Manager	$120,584	▼ 0.6%
Data Scientist*	$119,898	▲ 12.8%
MIS Manager	$119,877	▲ 2.5%
Data Engineer	$118,621	▲ 4.7%
Project Manager	$116,911	▲ 0.8%
DevOps Engineer*	$115,125	▲ 12.2%
Systems Engineer	$113,272	– N/A
Software Developer	$111,297	▲ 1.9%
Cybersecurity Analyst	$103,106	▲ 16.3%
Database Administrator	$99,038	▼ 4.9%
Business Analyst	$97,633	▲ 5.3%
UX/UI Designer*	$91,941	▲ 1.8%
Network Engineer	$91,561	▲ 1.4%
Mainframe Programmer*	$91,386	▼ 11.2%
Application Support Engineer	$90,039	– N/A
QA Engineer	$89,543	▲ 1.7%
Systems Analyst	$88,401	– N/A
Systems Administrator	$83,490	▲ 0.6%
Web Developer	$81,550	▲ 4.9%
Data Analyst	$76,001	– N/A
Technical Support Engineer	$68,651	▲ 8.2%
Help Desk Technician	$51,553	▼ 4.0%

Table 1. Average Salaries by Occupation from Dice.com

In a different report by the CEO of Talent, Colin Etheridge (2021), found that the two major factors that have increased the demand and opportunities for IT workers in the US is the move to remote working and the rise in the digital economy. The brick-and-mortar sector is finding the increasing need to go digital.

While the demand for IT talent is increasing, the job postings for other jobs have increased dramatically in the last few months. According to ZipRecruiter.com, the number of job postings has steadily increased but the labor force participation rate has remained flat (Figure 2). Popken (2021) speculates that the reason for

the lack of change in the labor market is due to several reasons:

- Those not seeking employment due to lack of confidence, after trying to look for a job earlier in the year.
- Ongoing concerns about the virus, and childcare.
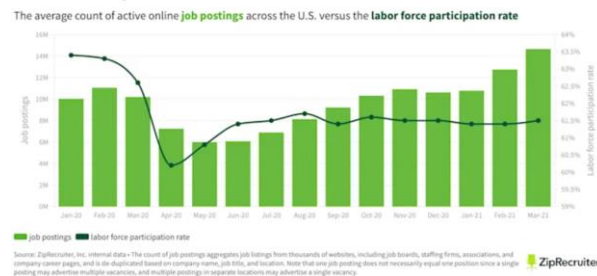- Economic impact payments.

Figure 2. ZipRecruiter Labor Force Participation and job postings

Jobs with the fastest growing demand, according to Lewis (2021), include big data developer and quality assurance engineer. April 2021 LinkedIn job posts showed jobs with the most demand overall included software engineer, application developer and project manager (Lewis, 2021).

3. METHODOLOGY

In order to analyze the specific job trends in information technology and how they compared to other employment demands, we analyzed raw data from Burning Glass technologies. Burning Glass has the following claim, "Powered by the world's largest and most sophisticated database of labor market data and talent, we deliver real-time data and breakthrough planning tools that inform careers, define academic programs, and shape workforces." (Burning Glass Technologies, 2021). We downloaded monthly data for the time period Jan 2020 to April 2021. These data included all job postings as well as specific job postings in science, engineering, information technology. They were analyzed using SPSS 26 and Microsoft Excel.

4. RESULTS

Appendix 1 and Table 2 show the top ten significant IT job titles and the correlation of their job trends over the period January 1, 2019 to April 30, 2021 according to Burning Glass Labor Insight. Software/Developer Engineer job trends far exceeds all the other job titles and shows a trend that maps to the pandemic timeframe. Job postings generally grew until

March 2020 when there was a steep decline (Figure 3). This trend continued until November 2020 when a slow recovery started, and which continues today.

	Software Developer / Engineer	
	Pearson Correlation	Sig. (2-tailed)
Software Developer / Engineer	1	
Computer Support Specialist	.894**	0.00
IT Project Manager	.929**	0.00
Systems Analyst	.946**	0.00
Computer Systems Engineer / Architect	.946**	0.00
Network Engineer / Architect	.916**	0.00
Network / Systems Administrator	.935**	0.00
Cyber / Information Security Engineer / Analyst	.873**	0.00
Web Developer	.922**	0.00
Software QA Engineer / Tester	.949**	0.00

Table 2. Top Ten Job Postings

To analyze each job title, the numbers were normalized to a 100% January 2019 base (Appendix 2). The normalized chart shows that generally each job category rose and fell and rose consistently across all job categories. A correlation analysis of trends across the ten jobs all have paired correlation coefficients above .873 and all are significant at p < .001. We can therefore suggest that all IT jobs were affected similarly by the pandemic.
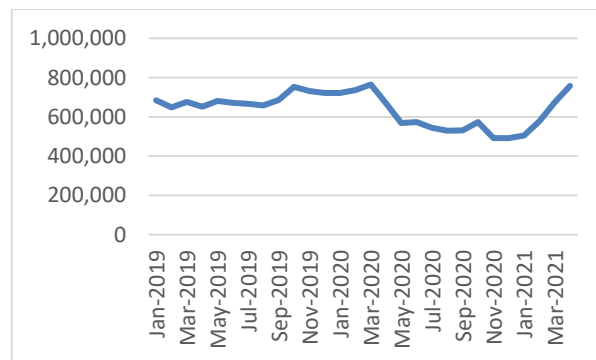
Figure 3. Total IT Job Postings

Figure 3 and Table 3 shows the full category of IT job postings during the period January 1, 2019 to April 30, 2021. The growth is fairly steady through March 2020. The COVID decline starts in April 2020 and continues through December 2020. The rebound growth began in January 2021 and continues through our available data period of April 2021. It should be noted that April 2021 job postings have recovered fully, and April 2021 was 11% above January 2019.

Period	IT		ALL	
Jan-19	▭	0%	▭	0%
Feb-19	▼	-5%	▼	-5%
Mar-19	▭	-1%	▭	0%
Apr-19	▼	-5%	▭	2%
May-19	▭	0%	▭	6%
Jun-19	▼	-2%	▭	1%
Jul-19	▼	-2%	▼	-2%
Aug-19	▼	-4%	▭	-1%
Sep-19	▭	0%	▭	1%
Oct-19	▭	10%	▭	9%
Nov-19	▭	7%	▭	3%
Dec-19	▭	6%	▭	3%
Jan-20	▭	6%	▭	6%
Feb-20	▭	8%	▭	10%
Mar-20	▭	12%	▭	15%
Apr-20	▼	-2%	▼	-8%
May-20	▼	-17%	▼	-17%
Jun-20	▼	-16%	▼	-9%
Jul-20	▼	-20%	▼	-3%
Aug-20	▼	-23%	▭	2%
Sep-20	▼	-22%	▭	8%
Oct-20	▼	-16%	▭	18%
Nov-20	▼	-28%	▭	9%
Dec-20	▼	-28%	▭	8%
Jan-21	▼	-26%	▭	11%
Feb-21	▼	-15%	▭	17%
Mar-21	▼	-2%	▲	37%
Apr-21	▭	11%	▲	51%

Table 3. Change in IT and all job postings

Though this seems to be an excellent recovery, we next examined how IT jobs fared compared to the economy as a whole. Figure 4 shows normalized job postings for All jobs in the Burning Glass database versus solely IT jobs. As is apparent, total job postings have far exceeded IT jobs since the COVID rebound.
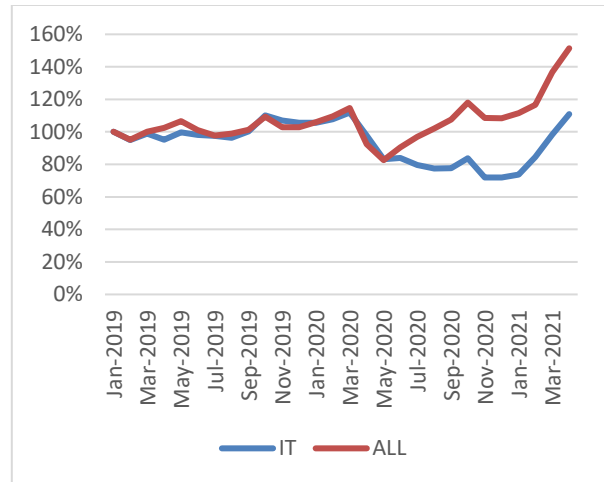

Figure 4. IT jobs Posting Vs All Job Postings

The match between total jobs was nearly perfect before and during the pandemic. But this has not been the case in the job market return. From January 2019 to March 2020 the correlation coefficient is .844 and $p < .000$. For the entire period though correlation is .219 and $p < .262$

Correlations

		Science	Engineering	IT
Science	Pearson Correlation	1	.612**	.304
	Sig. (2-tailed)		.001	.115
	N	28	28	28
Engineering	Pearson Correlation	.612**	1	.874**
	Sig. (2-tailed)	.001		.000
	N	28	28	28
IT	Pearson Correlation	.304	.874**	1
	Sig. (2-tailed)	.115	.000	
	N	28	28	28

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4. Science, Engineering, IT Demand

If we examine how IT jobs have recovered since the trough compared to other STEM positions, we see a similar puzzling lag in job growth. There is a significant correlation between Science and Engineering over the COVID time period to present. There is not a significant correlation between Science and Engineering and IT (figure 5).
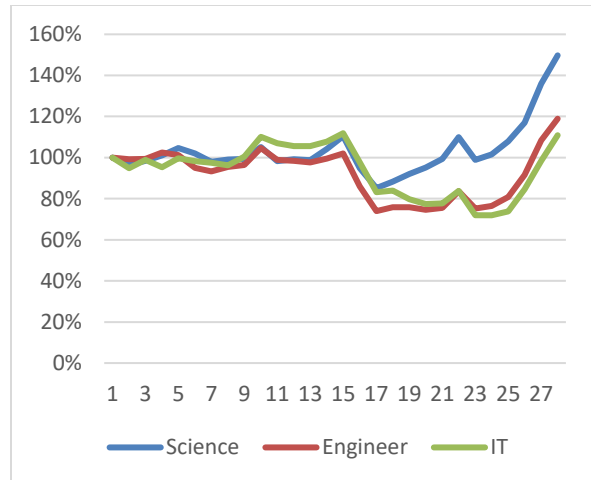
Figure 5. Relative Stem Job Growth

An area where there is demand that correlates with Science and Engineering is the IT sub-specialty, Cybersecurity. There is significant correlation for cybersecurity with both science and engineering (Table 5).

		Science	Engineering	CYBER
Science	Pearson Correlation	1	.612**	.427*
	Sig. (2-tailed)		.001	.023
	N	28	28	28
Engineering	Pearson Correlation	.612**	1	.662**
	Sig. (2-tailed)	.001		.000
	N	28	28	28
Cyber	Pearson Correlation	.427*	.662**	1
	Sig. (2-tailed)	.023	.000	
	N	28	28	28

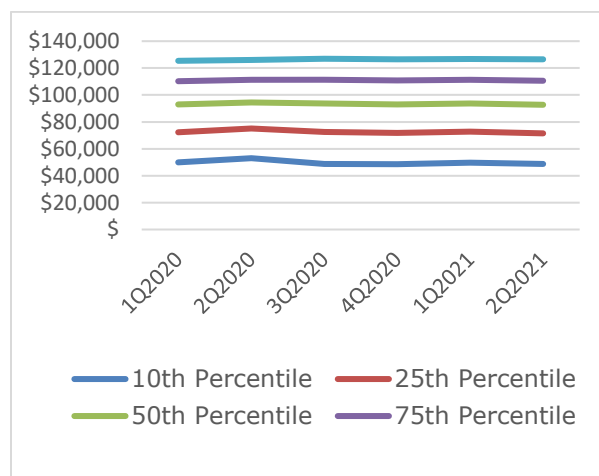**Table 5. Science, Engineering, Cybersecurity Demand**

Figure 6. IT Salary Trends Over Covid Timeframe

Finally, we examined IT salary trends over the COVID timeframe (figure 6). Here we see that,

in general, IT salary levels at all breakpoints are nearly unchanged from beginning to end.

5. DISCUSSION & CONCLUSIONS

COVID-19 disrupted business as usual for the worldwide workforce. Many workers lost their jobs, some permanently. For information technology workers, the good news is that IT employment is less than one percent below pre-COVID levels (Davis, 2020) and has created new opportunities. The economic fallout from the pandemic temporarily reduced demand in some skill sets, but, fortunately, strong job growth underscores longstanding talent shortages in IT. Expanding digital infrastructure was and still is important, "given the pandemic-fueled boost to the online economy" (Lund, 2021, pg. 20).

According to Ishani (2021), IT and software services companies shifted their focus to newer technologies such as data analytics, artificial intelligence, cloud computing and cybersecurity during the pandemic because of the impact these services have on the economy as a whole. These technologies, which were already growing, will require newer skill sets.

Furthermore, COVID-19 may "propel faster adoption of automation and artificial intelligence" (Lund, et al, 2021, pg. 11). Futhermore, workers will need to "learn more social and emotional skills, as well as technological skills, in order to move into occupations in higher wage brackets" (pg. 18). Women, young, less-educated workers, ethnic minorities, and immigrants "may need to make more occupation transitions after COVID-19" (pg. 19).

Our results show that job postings for information technology workers since the pandemic are lagging behind all jobs as well as science and engineering jobs. The reasons for this are unclear and require further study. Specifically, however, our results show that there is a strong demand for cybersecurity specialists. According to Vohra (2020), "the role of cybersecurity will gain greater traction in the post-COVID-19 era" (para. 2) and cybersecurity startups will "earn the favour of the investors" (para. 8). Davis (2020) asserts that professionals will want to focus on high-demand skills such as AI, cloud and cybersecurity.

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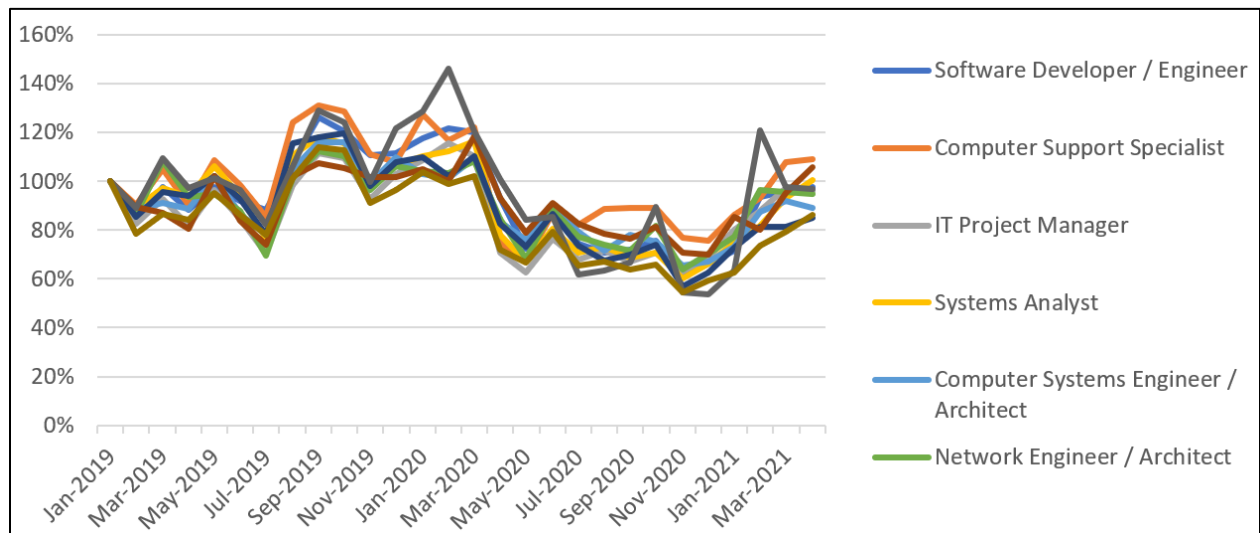
Editor's Note:

This paper was selected for inclusion in the journal as an CONISAR 2021 Meritorious Paper. The acceptance rate is typically 15% for this category of paper based on blind reviews from six or more peers including three or more former best papers authors who did not submit a paper in 2021.

Appendices
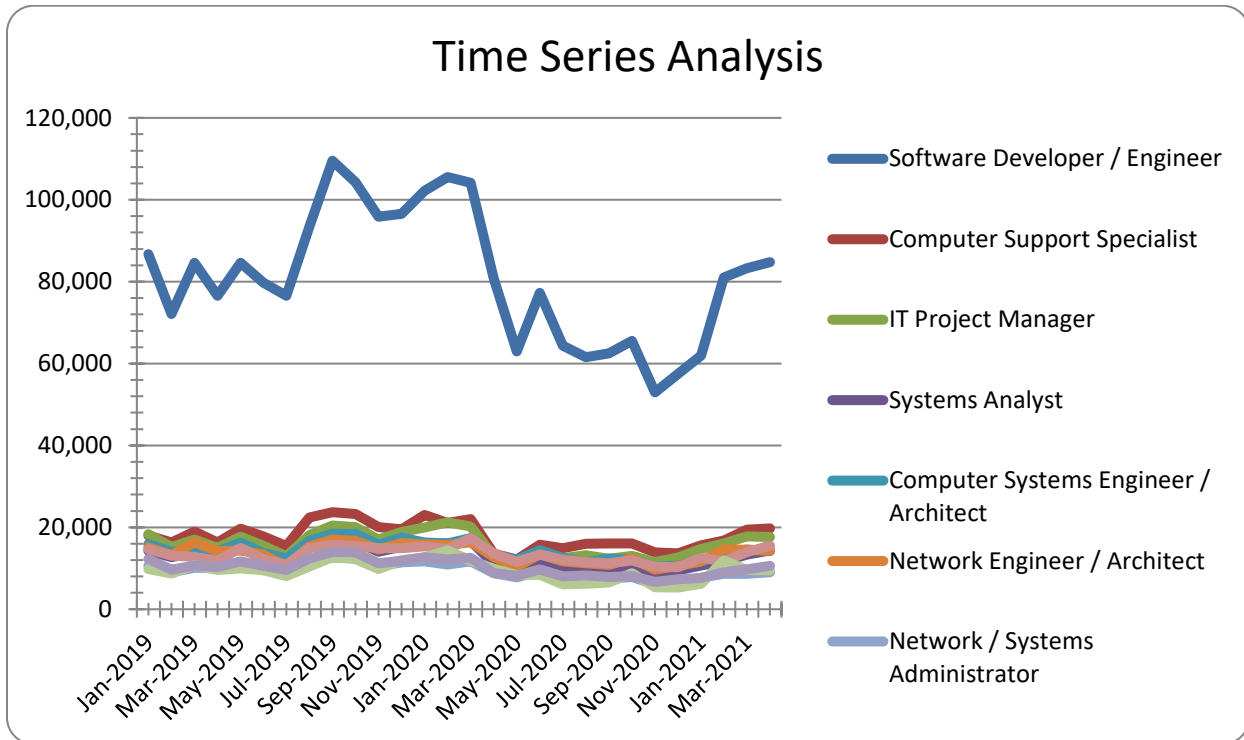
Appendix 1. Job Postings by IT Position

Appendix 2. Normalized Job Postings by IT Position