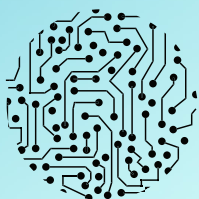


# **The Journal of Computing Sciences in Colleges**



# **CCSC**

CONSORTIUM FOR  
COMPUTING SCIENCES  
IN COLLEGES

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*ccsc.org*

**Papers of the 36th Annual CCSC  
Eastern Conference**

October 23rd-24th, 2020

Hood College

Frederick, MD

**Volume 36, Number 3**

**October 2020**

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Baochuan Lu, Editor  
Southwest Baptist University

John Wright, Regional Editor  
Juniata College

**Volume 36, Number 3**

**October 2020**

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## Welcome to the 2020 CCSC Eastern Conference

On behalf of the CCSCE 2020 Conference Committee, we would like to extend a warm welcome to those attending this 36th Annual Conference.

This year's conference was scheduled to be held at Hood College in Frederick, Maryland. In light of a global pandemic, our options were to cancel the conference or find a different, safe venue. The organizing committee decided to move the conference online, and we are delighted to see the response and everyone's participation. It proves that CCSCE is not just a conference but a community. Besides being the first CCSCE held online, this conference is a real testament to our community's ability to problem-solve, persevere, and move forward in the face of adversity.

Thank you to the educators from all levels of the computing sciences, including computer science, information systems, information technology, and so on, and the students in the related fields for attending the conference and contributing to the success of this Eastern Region Conference.

With the contributions from many of you, we have two days of excellent programs planned for the professional enrichment of our audiences, which include an invited keynote, paper presentations, workshops, tutorials, poster presentations, and a programming competition for the students. This year the conference had 26 professional paper submissions, out of which we have accepted 14 papers for an acceptance rate of 54%. All papers underwent a double-blind review process with on average papers that were reviewed by 3 reviewers.

The conference is supported by faculty from multiple institutions who served on the Conference Committee, as reviewers, etc. We want to express our sincere gratitude to everyone involved in making this conference a reality. Special thanks to all those who helped develop the program, coordinate the paper reviews, organized the programming competition, coordinated the keynote speaker, managed the production of the proceedings, coordinated panels, workshops, tutorials, nifty ideas, and lightning talks. Our gratitude also goes to the judges for the poster awards, the session chairs, and student volunteers. We also appreciate the continuous effort and support from the CCSC Eastern Region Steering Committee, and we are very grateful for the generous supports of the CCSC National Partners, Sponsors, and Vendors.

Lastly, this conference is unique because we also have a bitter-sweet "change of guard." Our colleague, John Wright (Juniata College), who has been the steward of several CCSCE conferences over the years, is stepping down as the CCSC Eastern Representative. John's contributions to our community and the CCSCE conferences are innumerable, and his work and always helpful disposition has been nothing but exemplary. We thank him for his tireless support and welcome Mike Flinn (Frostburg State University) as the new Representative.

We hope you have an excellent and productive conference!

George Dimitoglou and Jiang Li  
Conference Co-Chairs  
Hood College

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# The "What's Next Economy"\*

## Keynote Address

*Jonathan Aberman*

*Dean, School of Business and Technology  
Marymount University, Arlington, VA 22201*

The COVID-19 pandemic has changed our society and economy already, with many more challenges and changes to come. Jonathan Aberman, Dean of Marymount University School of Business and Technology is a national expert on innovation, economic trends and entrepreneurship. He believes that the United States has entered a new phase, which he describes as the "What's Next Economy?" He will discuss some of the hallmarks of the What's Next Economy and what it means for technologists, educators and policy makers.

## Academic Credentials

Jonathan's academic qualifications are in the fields of economics and law. He earned BA degrees from George Washington University (Political Science and Economics) and Cambridge University (Law). He subsequently obtained a graduate degree in Economics from the London School of Economics (MSc in Economics). He completed his legal education at Cambridge University (MA) and New York University (LLM).

## Speaker Bio

Jonathan Aberman is a highly respected thought leader on entrepreneurship and innovation. His experience as a venture investor, innovation consultant, university professor and media commentator gives him a 360-degree perspective on entrepreneurship and technology innovation. He is identified as a leader of change and influence in print and television media, recognized by Washingtonian magazine as a "Tech Titan," by the Washington Business Journal as a member of the "Power 100" and by the Commonwealth of Virginia as one of its "50 Most Influential Entrepreneurs" in the Commonwealth." Forbes Magazine described him as the "unsung hero" of the successful attraction of Amazon HQ2 to Arlington, Virginia.

Jonathan has unique expertise in the melding of national security and entrepreneurship with technology commercialization. He has worked on these matters with a number of national security agencies and universities including DOD Laboratory establishment, DARPA, the Air Force, the Army, the Department of Homeland Security, George Mason University and the University

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of Maryland at College Park. His activities regarding entrepreneurship and national security resulted in the formation of Tandem National Security Innovations, a national innovation community that has helped national security entities such as DARPA, DHS, SOCOM, JSOC and others find and engage with nontraditional sources of innovation.

Through his closely held investment business, Amplifier Ventures, Jonathan has helped to start 16 technology businesses since 2005. Among these businesses are successful companies in cybersecurity, mobile communications, internet and mobile content and software. Before starting Amplifier Ventures, he had a 15-year career as a partner and senior manager of a number of national law firms, and prior to that he was an associate in the investment banking industry in London, England. He uses his commercial experience to provide valuable strategic advice, business model and customer discovery acumen and deal management. His experiences and contacts in the venture capital industry inform his views on technology innovation and provide a hard earned commercial perspective that he applies to his work.

Jonathan is a committed educator. Prior to joining Marymount he spent 11 years as a Lecturer of Entrepreneurship at the University of Maryland's Smith School of Business, where he taught a broad range of courses including business formation, corporate finance, business strategy, and family entrepreneurship.

He also has a significant media footprint. He hosts What's Working in Washington, a podcast and weekly radio show on Federal News Network's WFED (AM 1500) examining innovation in one of the least understood business communities in the country. From 2015 until joining Marymount, Jonathan had a regular column, first in the Washington Post and then in the Washington Business Journal, covering the region's business community, innovation, entrepreneurship and economic development. He is often quoted in national publications including Bloomberg, CNN, Wall Street Journal and The New York Times, and he actively participates on panels and serves as a keynote speaker for innovation, entrepreneurship and technology events.

During his career Jonathan has helped to create many successful communities of entrepreneurs. In 2011, he founded Startup Virginia, Startup Maryland and StartupDC as part of the Obama Administration's StartupAmerica Initiative. These efforts resulted in the formation of regionally impactful programs including 1776 Accelerator and the iCorps program. In 2012 he formed FounderCorps, a not for profit that aggregated many of the Greater Washington region's most prominent entrepreneurs and promoted mentorship. In 2018, he formed the Tandem Product Academy, an educational program focused on teaching founders and senior executives essential skills necessary to scale technology product-based businesses.

# Programming With the Cloud\*

## National Partner Session

*Laurie White*  
*Cloud DevRel*  
*Google for Education*

While there's a lot to learn about cloud computing, the cloud can also be used in classes as fundamental as programming courses with little change to the material being taught. The cloud can provide a uniform programming environment for students regardless of the computers they use to access it remotely. It can provide computing resources beyond what some students may have on their own computers. And there are even some cloud services that can be used to make even the simplest programming assignments more interesting.

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# Techniques to Effectively Teach a Course Online\*

## National Partner Session

*Yamuna Rajasekhar*  
*zyBooks*

With universities in the COVID environment moving to online instruction, many instructors are having to teach courses online. In order to achieve the same student performance as in-person instruction, instructors have to break away from conventional teaching methods and adapt their teaching techniques. This talk presents an overview of zyBooks, which are interactive, online textbooks for the STEM fields that have proven to increase student confidence in STEM courses. The talk also outlines techniques to make online instruction interactive and engaging for the student. Additionally, student performance results are presented from an online computer science course taught at the University of California, Riverside.

**About the Speaker:** Yamuna Rajasekhar received her Ph.D. in Electrical Engineering from the UNC Charlotte. She served as a faculty member at Miami University where her research was focused on assistive technology, embedded systems, and engineering education. She is currently a Content Developer at zyBooks, a startup that develops highly-interactive, web-native textbooks for a variety of STEM disciplines.

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# Fileless Malware and Programmatic Method of Detection\*

## Student Paper Abstract

*Pipop Nuangpookka, Zelalem Mengistu, Ghada Bafail*  
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Fileless malware lives unnoticeably in a computer system's main memory and executes its malicious processes freely. Although the anti-malware industry knows about this sophisticated form of attack and provides protective capabilities to detect such threats, Fileless Malware is violently relentless which makes the detection process so difficult, and yet challenging. The moment cybersecurity professionals came out with a robust and effective countermeasure, malware threat landscapes were also evolved to avoid detection and increasingly becoming more sophisticated. Furthermore, since fileless malwares does not use or reside on the file system, they could not be easily detected on any signature-aware antivirus detection system. Due to this fact, fileless malware attack vector is disastrous for any organization (government, private). It is reliance on an existing operating system and approved tools makes the attack too subtle. Despite the illusive nature of fileless malware, cybersecurity professionals use forensic tools to trace the attacker, which most, if not all of the time could be unsuccessful as the attackers might implement an anti-forensic tools to evade detection and or traces. This research work/ experiment aims at compromising a computer system by executing malicious scripts or payloads on a web browser remotely using JavaScript without requiring an installation of a file on the targeted computer system. The method of the attack is to take advantage of the feature of a Web Interface's Application Programming Interface (API), ActiveXObject, provided by Microsoft Corporation. Accordingly, the potential exploitation may only be possible to the users accessing websites by using Internet Explorer web browsers. Extensible + Apache + MariaDB + PHP + Perl (XAMPP) webserver were installed on a Microsoft Windows 8

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machine to initiate fileless malware processes and a Java Development Kit and Java Runtime Environment 8 were the programming language for the implementation of a method of detection. Finally, we were also able to replicate the execution of legitimate CMD commands on a remote host through a malicious JavaScript. Hence, it only takes one mistake, or one click from an unaware user to get exploited, unintentionally. Fortunately, we were able to implement a monitoring process to detect such a threat using a Java code which executes the CMD command programmatically every three seconds using the technique of Multi-Thread Programming (i.e., Ability to control sequence of time for execution). In other words, when the ActiveXObject is active, it will detect the malicious CMD process. Such information would be valuable to an observer who should be able to react to this suspicious CMD activity promptly.

# Maturity of the Malware Marketplace a Disturbing Trend using Probability Density Function\*

## Student Paper Abstract

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The centralization of malware variance signals an increase in the maturity of the malware marketplace and the operations that produce them. Since the early 1970s until today, malware has exponentially increased in volume and dispersion, but in early 2017 the trend showed a remarkable shift. For the first time in nearly 50 years AV-Test trend showed a decreased variance in malware file variance had declined. This paper examined whether the probability density function explain the diminishing of new malware specimens reported in malware trend. the researchers found that probability density function could predicted the likelihood of the diminishing of new malware specimens published by AV-Test in 2017. The Gamma-Poisson Distribution is the model used for describing randomly occurring of malware specimens reported and determine the probability of a number of malware specimens reported in 10-years period or finding the probability of waiting some time until the next number of malware specimens reported. The study concluded that the probability density function predicted for an expected likelihood of 0.25, 0.10 and 0.01 a descending trends of new malware specimens (in million) between 2007 and 2013 was closer to 0 in 2014.

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# Performance Analysis of the Lamp Stack Compared to Its Variants in a Single Page Web Application Environment\*

## Student Paper Abstract

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For over two decades, the LAMP stack has been one of the most popular open-source application stacks for web development. As the web ecosystem has evolved and new open source software has been made available, is the LAMP stack still viable? This paper analyzes the performance of the classic LAMP stack when compared to its variants in a single page web application environment.

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# Credit Card Fraud Detection: An Evaluation of SMOTE Resampling and Machine Learning Model Performance\*

## Student Paper Abstract

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Credit card fraud has been a noted security issue that requires financial organizations to improve their fraud detection system continuously. In most cases, a credit transaction dataset is expected to have a significantly larger number of normal transactions than fraud transactions. Therefore, the accuracy of a fraud detection system depends on building a model that can adequately handle such an imbalanced dataset. The purpose of this paper is to explore one of the techniques of dataset rebalancing, the Synthetic Minority Oversampling Technique (SMOTE). To evaluate the effects of this technique on model training, we selected four basic classification algorithms, Complement Naïve Bayes (CNB), K Nearest Neighbor (KNN), Random Forest, and Support Vector Machine (SVM). We then compared the performances of the four models trained on the rebalanced and original dataset using the Area Under Precision-Recall Curve (AUPRC) plots.

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# Supporting Underrepresented Groups in STEM During Uncertain Times: A Case for Transfer Students from Rural SW PA

## Panel Discussion

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The panelists have been awarded a National Science Foundation grant to broaden the participation of underrepresented student groups in STEM. The goal of the program is to attract students who have an aptitude for the STEM subjects, but for various reasons may not be able to complete their undergraduate degrees. They may face lack of support and mentorship from their families and peers, insufficient income, psychological barriers, and many other difficulties.

The panel discussion will focus on the efforts it has made to continuously provide support to Underrepresented Students during the onslaught of the COVID-19 pandemic and in the semesters after the 2020 nationwide lockdown. The panelists have received an award from the National Science Foundation to broaden the participation of underrepresented groups in STEM and they will be encouraging conversation around creating inclusive avenues for support for their students. The challenges colleges and universities are facing with navigating what might be a new normal cannot overshadow the gap that is created when students in this group are left to make meaning of their academic journeys as well as the hurdles that they will encounter in an ever changing job market.

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# Partitioned-Hill Cryptosystems: A STEM Lab for AP CSA\*

## Nifty Assignment

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A Partitioned-Hill Cryptosystem uses a sequence of randomly generated matrix affine ciphers,  $AX + B$ , of different random dimensions, that are determined by a randomly generated partition of the plaintext string.

A Partitioned-Hill random sequence cipher is a symmetric cipher comprised of random blocks, which by design has good intrinsic security due to the difficulty of both searching all partitions of a plaintext string and searching all invertible (mod  $k$ ) matrices of dimension  $n \geq 3$ . In practice, the plaintext string is first partitioned into superblocks of a fixed size, e.g.  $m = 15$ , for which partition numbers are easily computed and used to select a random partition of each superblock. Finally, random matrix affine block ciphers are generated corresponding to the random partition of each superblock.

This work is an especially useful example of significant STEM integration that combines current and important subject matter content from linear algebra, number theory, computer science, cryptology, and cybersecurity. STEM students seem to respond well to computer science labs that provide a learning environment containing both relevant and challenging programming problems that motivate and necessitate the invention and use of complex data structures and algorithms.

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# Nifty Assignment in Computer Networking Laboratory\*

## Nifty Assignment

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Park University Faculty Center for Innovation obtained a grant through the Ewing Marion Kauffman Foundation, allowing the author of this proposal and 49 other instructors at the University to participate in a 32-week long course entitled Effective Teaching Practice. The course was offered through the Association of College and University Educators (ACUE) in conjunction with American Council on Education (ACE). One important concept that the author learned through the course is called “Transparent Assignment.” The ACUE course module explains that “a transparent assignment is an assignment that aligns with the course learning outcomes.” To develop a transparent assignment, one starts with a course learning outcome, goes through a 3-step process to create a teaching planner, and finally applies a transparent assignment template to create an actual assignment.

At the time of taking the ACUE course, the author was teaching a Computer Networking Laboratory course. So she used this networking course to practice and utilize the effective teaching practices she learned from the ACUE course. She created a transparent assignment for the Computer Networking Laboratory course and gave it to the students as a capstone project at the end of the semester.

This presentation will describe what a transparent assignment is, and show the steps of how to develop a transparent assignment using the Computer Networking Laboratory course as an example.

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# Containerizing CS Learning Environments\*

## Poster Abstract

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This work describes an attempt to create a containerized platform to support various computing resources for hands-on activities throughout the CS curriculum. Via containerization, students will have the opportunity to become engaged regardless of their personal computing devices. The baseline container images will be lightweight, and the number of images is minimized to reduce storage impacts on students taking multiple courses. Similarly, efforts will be made to ensure additional image layers can be reused across courses. Our platform must work with all three majors operating systems, be lightweight, and preferably be portable across personal and remote computing environments. It can also solve challenges in making sure hands-on lectures on various attacks remain up-to-date regardless of how the related system libraries are changed over time. The poster will have four major areas. The first area showcases existing courses with containerized components, broken down to individual image layers. It provides information on motivations and preliminary successes of our various courses that utilize containers in individual lectures, particularly with complex exercises. The second area, where a common platform is envisioned, is to create a merging common low-level container layers, with customized top-layers for the majority of junior and senior level courses at the authors' institution. The third area includes large bullet points identifying potential faculty's adoption challenges and students' usage challenges. The fourth area, connected to various courses in the second area, describes possible assessments on the effectiveness of containerization at different courses. We envision that this platform, shared among our CS courses, would greatly help instructors to share experience in incorporating and deploying new learning components and addressing common technical issues. Additional benefits of containerization also include the possibility of deploying large-scale computing environment for education, whether on local, federal, or industry cloud resources.

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# 3D Printed Models for Teaching Data Structures\*

## Poster Abstract

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The data structures course is a fundamental course in Computer Science education. It describes and compares the different structures that can be used to store data in memory. The course typically covers arrays, stacks, queues, hash tables, trees, and graphs at least. The emphasis is on the different features of each and when it is most suitable to use it. And therefore, students need to visualize the data structures in memory and how they are used. This is traditionally done by showing diagrams and animations of the data structure being used. For example, a stack having data pushed and popped from it, or a binary tree changing shape with data insertion and removals.

We designed a set of 3D printed models that represents the different data structures. They enable students to better visualize them in memory, and to compare the structure of consecutive and non-consecutive memory allocation. This is particularly useful for explaining data structures with pointers such as linked lists and trees. Students were involved in the design of the 3D structures and the actual printing process. Four basic data structures were designed and printed during the spring 2020 semester: arrays, stacks, queues and linked lists. The data and memory addresses was represented as cubes with numbers printed on them that are inserted into the 3D frames representing the memory locations.

The students found the structures very useful and stated so in the course evaluations. The next challenge is the 3D design for a binary tree that can support the addition and removal of nodes. Several ideas were discussed using arrows, ropes and hooks, and the implementation of them will be built and compared in the fall 2020 semester. A complete data structure demo set will be published as an instruction aid for data structures courses in high schools and colleges.

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# Computational Thinking for Computer Science Majors: An Introduction to CS Education Career Pathways\*

## Poster Abstract

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In general, computer science majors do not consider K-12 education as a career pathway. A potential reason is a lack of introduction to the career path during their undergraduate careers. In this project, supported through a grant from the Maryland Center for Computing Education ([cs4md.org](http://cs4md.org)), we developed a pilot computational thinking course blending computer science majors and pre-service teachers. The course focused on describing and integrating computational thinking in a way that would translate to K-12 classrooms while utilizing non-programming based computational tools to demonstrate these ideas. Participants were able to put these ideas into practice in K-8 classrooms during the course and reflect on how the lessons were received. We discuss the implementation of the course, field placement, motivations, and our initial analysis of survey data, including impacts on attitudes on education as a career choice for computer science majors.

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# A Multi-Cloud Environment for Teaching Relational Database Services\*

## Poster Abstract

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In today's business world, it has become standard practice to use cloud computing to host data and application alike. Instead of equipping with server rooms with expensive yet soon becoming outdated server computers, and a number of system and database administrators, now companies may "rent" the hosting services for database systems and applications. Cloud computing has its advantage being more cost-effective, just thinking about the average annual salary and benefits for database or system administrators. The other benefit of cloud computing is elastic. Companies can easily upgrade its cloud service level during peak business times, and downgrade the cloud service level afterwards.

On the other hand, cloud computing has also brought several concerns for business users. Security of data, reliability of application services, and availability of data and applications are among a few of these concerns. As cloud computing has infused into daily businesses, it has become an arguable point whether it is safer to store your business data compared to in-house data storage. People have been stating that "data is new currency". As a result, storing data in storage cloud would be like depositing cash into banks, and it should be safer than storing data onto in-house data storage. Nevertheless, the reliability and availability of data and application services over the cloud are still the major concern for companies who are exploring serverless computing environment for their business.

A multi-cloud database is a particular distributed database environment that makes use of multiple database storage engines over more than one cloud

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computing platforms, aiming to providing reliable and efficient data access services to achieve an organization's datacenter goal. It combines data storage services over multiple, private or public, cloud computing platforms, which may augment benefits of data services from a single cloud computing platform.

Since cloud computing has become a dominant platform in providing database storage services for modern applications, college graduates equipped with cloud computing knowledge and skills gain competitive edge over job market. It is therefore critical for us as computer science educators to offer students opportunities to work on projects in this area to understand how modern computing platforms work and to stay current and front in this dynamic field of information technology.

In this poster, we present our investigation and findings over multi-cloud database systems, with focus on projects that undergraduate students could leverage to understand the fundamentals of cloud computing, its advantage and tradeoff, and its programming paradigm. An application framework for Java developers to access data from multi-cloud database systems is also described.

# Introducing Computational Thinking to Pre-service Teachers\*

## Poster Abstract

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Computational, logic thinking and problem-solving skills are extremely important for students' success in the future. This poster describes a collaborative project that was conducted to promote K-8 Computer Science Education among in-service and pre-service teachers. More than 40 pre-service and in-service teachers participated in a learning experience designed to address the K-12 Computer Science Framework and Maryland's K-12 Computer Science Standards. The collaboration was designed to facilitate participants' learning about and application of foundational principles of computer science and computational thinking into K-8 STEM curriculum and teaching. Participants explored hard/software platforms and used open source sites such as Scratch, Code.org and Code Academy. Participants envisioned how activities apply to K-8 classrooms and worked in pairs or groups to design a problem-based project for students. Project evaluation included formative and summative assessments to examine changes in content and pedagogical knowledge.

## Acknowledgement

Our professional development events were sponsored by Maryland Preservice Computer Science Teacher Education Program, we appreciate Maryland Center for Computing Education team for allowing us to provide such great opportunities to our pre-service teachers in CS education.

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# Low-Code/No-Code Software Development Platforms and their Uses in Computer Science and Information Technology Education\*

## Faculty Poster Abstract

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Low Code/No-Code (LCNC) software development has gained its share and popularity in today's software development market, especially in cloud-based application development. In addition to companies specializing in LCNC software development such as Appian, OutSystems and Mendix, major cloud service providers, such as Amazon, Microsoft and Google, have all released their LCNC development platforms.

In this poster, we describe our experience in using LCNC platforms in Computer Science (CS) and Information Technology (IT) classrooms, and our observations and lessons learned from integrating LCNC concepts and using LCNC platforms in teaching a variety of CS and IT concepts. It is evident that students must equip with solid fundamental concepts in order to use LCNC platforms effectively and efficiently. In addition, we believe there will always be need for traditional programmers. LCNC and traditional programming that has always been taught in CS/IT curriculum may very well complement each other in future software development.

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# Towards Understanding Privacy Trade-Off in an Epidemic\*

## Poster Abstract

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Although the COVID-19 is still as complicated as ever, it is a significant job for private networks across the globe to gather and share data in the light of the battle against coronavirus. The scale and severity of the disease are not rare, but they seem to be near it. Consequently, drastic steps to remedy the situation seem to be the rule in a very short period of time. As the coronavirus pandemic spread across the world, countries developed massively controlled networks to track virus transmission and forced governments all over the world to take into account trade in health and protection for millions of people. In certain cases, the whole population has been intensively monitored and diagnostic records from those who are infected with the virus are usually distributed around organizations and nations. While in many countries innovative approaches have been introduced to counter this, privacy advocates are concerned that technology would eventually erode privacy, while regulators and supporters are concerned about the type of effect that this may have.

In our research, we found that the best way is to strike the right balance. Systematic study on different data security problems at different fronts during the pandemic shows that multiple privacy strategies, including privacy protection measures, aggregated anonymized data and collaborative data for software and device designers would help them reliably exploit and stay effective with data from third parties without violating user privacy or confidentiality. The cases related to the ability of public authorities to intervene with the fundamental right to privacy in the interests of national security or public safety have consistently shown the prospect of achieving a fair balance if the global scientific community, and government leaders make a concerted effort to standardize Privacy Enhancing Technologies (PETs), such as ZKProof, to encourage broader adoption.

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# Privacy and Security Vulnerabilities in Health Care Infrastructure Mobile Technology\*

## Poster Abstract

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The intense penetration of mobile devices into our everyday lives has fundamentally changed how we interact with each other in any sector. It also refers to the healthcare sector, in which technology is becoming increasingly relevant in nearly all areas of the industry. The inventing of modern software applications and digital advances have now allowed patients to view medical records using mobile apps, check up on their main alerts, navigate and organize healthcare, and execute a large variety of activities more conveniently. Mobile apps and technology provide a great deal of benefits for consumers, while a range of problems in terms of health, usability, and risks are often known. Health care companies are gradually seeking to upgrade their aging technologies to meet these concerns by incorporating the use of mobile apps. The proliferation of mobile apps and technologies also provides the company with new challenges and dangers. We find Epic Rover as a test case, a smartphone application described as a potential alternative for the control of electronic medical devices.

In our research, we consider a safety team including CISO, the technology consultant, technology engineer, and chief enforcement officer to evaluate a suitable mobile application for a fictional health agency, as well as to assess whether or not its use is worth the risk to that organization. We discuss data that the security department is looking to determine and thoroughly assess the vulnerable circumstances and threats posed by mobile devices in the health sector prior to the launch of the latest technologies using Epic Rover mobile Software, an advanced Product from Epic Systems, a leading vendor of Health Care Technology, and propose risk management and mitigation strategies while ensuring compliance with regulatory requirements.

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# Benchmarking the Performance of RESTful Applications Implemented in Spring Boot Java and MS.Net Core\*

## Poster Abstract

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RESTful is stateless, lightweight, and predominant architectural style to design and develop web services/applications. This paper aims to benchmark the performance of RESTful web applications implemented using two different technologies: Spring Boot Java and MS.Net Core. Both implementations were developed using the same business use case to provide the basic four Create, Read, Update, and Delete (CRUD) operations. Apache JMeter 5.2.1, an automated java-based performance testing tool, was used to create virtual users to load both the applications at regular intervals. The comprehensive experimental results are presented at the end of the paper.

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# Parsing Performance of Native JSON Libraries in Java, MS.Net Core, and Python: A Comparative Study\*

## Poster Abstract

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The emergence of JSON as a popular data interchange format has motivated the software industry to provide support for JSON in their native environment. As a result, JSON is now supported in most of the software solutions. The performance of JSON parsing, however, varies with internal implementation of a JSON parser. In this research paper, native JSON parsers in 3 programming platforms Java, MS.Net core, and Python have been studied in order to compare their parsing performance. The innermost keyvalue pair was accessed from the JSON data with varying degree of depth as the criteria to evaluate and analyze the parsing efficiency of JSON parsers in terms of parsing speed. The experimental results are discussed and shared at the end of this research paper.

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# Lesson Plan: An Interdisciplinary Approach to Teaching Cyber Warfare Concepts\*

## Poster Abstract

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This poster supports the idea that Cybersecurity, and thus cyber warfare are interdisciplinary topics. Based on the concepts that are covered from course descriptions on cyber warfare at various levels of study and from different disciplines, including computer science, criminal justice, and international relations the poster provides support for a single lesson plan on cyber warfare that includes learning competencies, recommended current materials, and easy to implement classroom activities. The lesson plan can be modified as needed for introducing the concepts of cyber warfare across disciplines.

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# Robotics-Based Creative Expression for Middle/High School Female Students\*

## Faculty Poster Abstract

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Innovation in computing require talents from diverse backgrounds. Given the lack of female participation in computer science, we propose to integrate artistic practice, such as choreography design and video production, into educational Robotics. Our goal is to create computing experience that can relate to and engage female students, and to encourage them to use computer science as a tool for self-expression. Based on PLEN:bit, a unique robotics device, we created lesson plans based on this idea and offered teaching sessions at four schools with diverse ethnic populations. Our study shows that the proposed method is effective in helping students learn basic programming concepts. More importantly, it increases middle/high school female students' interest in computer science and leads to a positive change of female students' attitude toward programming.

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# Artificial Intelligence Operated Data Warehouse\*

## Student Poster Abstract

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In this research, we developed a multilayered inventory management software which pledges to revolutionize how inventories are sorted and maintained. However, current inventory management software fails to analyze for optimal methods for how and where inventory stock should be stored. Instead, many inventories solely act as a tool by which users manually maintain and allocate parts. Thus, the heavy burden calling for frequent rearrangement of parts, reflected by supply and demand falls onto employees and management.

Systematically, our software utilizes sophisticated AI (Artificial Intelligence) which interprets part data such as type or dimensions. It then analyzes sales history and other data to optimize the inventory. This method is achievable due to various channels which simulate and virtually represent an existing storage arrangement within a department. By knowing the available space, the size of parts, the history of sales and other data, the software will be able to observe best practices for part arrangement. In addition, proposed software accounts for frequency, sale association, and part dimensions without requiring our clients to change their existing storage facilities. Nonetheless, it is crucial to strengthen the available tools for inventory management to drive the management process rather than simply supporting it. Utilization of this software will improve efficiency, specific to relay times in part retrieval, speed of stocking new parts, improvement of shelf utilization, and ultimately adapting seamlessly to growing or changing inventories. Through thoroughly understanding the principles and guidelines for data warehousing, this software effectively meets the demand within the market for data mining tools specific to achieving inventory management objectives

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# MyHealthChart Mobile App: Gives People Control and Access to Their Medical Records\*

## Student Poster Abstract

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MyHealthChart is a mobile application that is specifically designed for families, elderly people, caregivers, and people who are chronically ill or have longterm illnesses. With a focus on the seven top chronic diseases in America per the CDC, our goal is to give people a new option to store and access their medical information with the touch of a button in a secure digital format. To the best of our knowledge, this is a novel application of its kind. However, MyHealthChart is an organizational tool used to centralize all of a user's medical information in one place, complete with an interface designed to meet the needs of people with disabilities by including large buttons and a color-blind friendly design. Each user can store information about their doctors, appointments, prescriptions, and vaccines with multi-user capabilities to extend usage to the whole family. This mobile application has many more features, such as reminding users of upcoming appointments or when to take their medicine, and the ability to attach a picture, such as an X-ray or an injury, inside of a medical note. MyHealthChart can also produce a range of medical reports based on previously reported data and allows a user to generate daily health charts based on their specific needs. MyHealthChart eliminates the need for patients to pay for medical records from their doctor's office, recall medical details from memory, or search through a filing cabinet at home for specific medical information by replacing the traditional paper filing system. Lastly, we strongly believe, MyHealthChart will revolutionize personal medical record keeping and serve as a double-checking mechanism for medical information documented by doctors and caregivers.

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# An Interactive Mobile Application for Skin Clinic\*

## Student Poster Abstract

*Khalid Noman, Mohamed Barodi, Ahmed Noman,  
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A mobile application is developed and implemented to streamline communication between a clinic and its customers. This application will allow the clinic to relay some vital information about the clinic, its services and will also give the customers a chance to interact with the clinic beyond operational hours. The primary objective of the application is to provide a communication service for a dermatology and laser clinic. It will enable communication with their customers over a medium that is not direct contact or social media based. This type of application is commonly used in the USA but other countries still need this type of application. This application is currently used by Skin Essentials Dermatology and Laser clinic, Saudi Arabia who was the client for this project.

In terms of service, the mobile application has the ability to provide functionality for the customers, doctors and hospital administrators. The customers can get information about the services provided, information regarding the doctors and their specialties. Besides, this application is also equipped with a registration process which will eliminate long waiting time upon arrival for both customers and respective doctors. It will be also helpful to reduce number of people gathering in a space, especially in a situation like ongoing COVID-19 pandemic. Nonetheless, the appointment request should eliminate the need to directly contact the clinic to request an appointment. It will exclude the possible waiting time and any technical difficulties that arises during an appointment scheduling process. The feedback function will give customers the capability to evaluate their satisfaction about the clinic or their visit. Currently, these services can be modified by the system administrator by editing

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in the database, but a function in the computer application is currently being developed to give the clinic the simplest method of editing their services. The applications can help the clinic in relaying information to their customer base with a single application that the customers can use on their android mobile devices. The mobile application will allow the customers of the clinic to relay information back to the clinic. The mobile application is developed for the general customer that requires a simple interface and efficient usability. The customer and the client satisfactory feedback ensures the easy accessibility, usability and proficiency in error handling for this application.

# Gear Shifting: Back to the Basics Phase 1\*

## Student Poster Abstract

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A gear shifting study to improve child biking was being conducted by Meghan Murphy, a sophomore at Frostburg State University. The problem is the difficulty of comprehending why gears are needed. Children do not understand the complexity of gear shifting. At young ages, children do not have enough biking experience and knowledge to transition between gears properly. According to the Journal of Sport & Exercise Psychology, children at younger ages of 5-7 years do not use a strategy while riding their bike compared to older children of 8-10 years of age. The second part of their study showed that all age groups made fewer errors when given a strategy for riding (Liu, T., & Jensen, J. L., 2007). Also, Cannoni stated that mechanical reasoning develops around the ages of 7 and 8. At an average age of 8 years, the child can state how a bike works (Cannoni, Elenora, et al., 2018). It could be reasoned that at these young ages, children are still trying to understand the bike and cannot fully comprehend gear shifting. Gear shifting comes with experiencing and understanding the terrain. Children are not developed enough to completely apprehend this topic, so they need help learning this fundamental bike skill.

The purpose of this study was to better understand the process of learning how to shift gears at a young age. A survey was administered to collect data. This study helped gained insight into useful aspects which will help develop a gear shifting app. For the following phase, the goal is to create an app that could help children ages 7 years old and older to know when to change gears. The final product will assist children in learning to shift gears properly and efficiently.

The poster presentation will include my abstract, purpose, example question of my survey, data gathered from the survey, results of the survey, and

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future app creation plans. The poster will explain my reasoning to conduct this research followed by the survey that I produced to get feedback from bikers. The study was used to determine the importance of gear shifting and obtain information about average cadence and timing to switch gears. This information will be used to create the app. The poster will contain features of the planned app as well as a mockup. The poster presentation will give the viewer an overall idea of my research on gear shifting.

# Homeostasis and Machine Learning in the Biology Classroom\*

## Student Poster Abstract

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Pediatric Cardiology and Machine Learning technologies are helping young patients understand their symptoms, while helping them to improve their condition. Understanding how some students of ethnic backgrounds can have pre-existing conditions that may progress to other diseases as they grow older (i.e. heart disease, high blood pressure, and diabetes) is a major concern. These students in some cases have poorer health standards due primarily to their economic status. The lack of nutritional choices in their diet correlates to higher risk factors and ultimately high blood pressure or diabetes. Students without these factors need to understand that maintaining a healthy lifestyle will decrease the likelihood of developing these diseases during their lifetime. The objective of this poster is first, to help students and young adults change their understanding of what causes heart disease and diabetes. Second, to introduce them to computer science concepts that will help them analyze risk factors that lead to heart disease and diabetes, while tracking changes that can be made once they are aware. Third, students will use machine learning to collect pertinent data to analyze and compare. This analysis will help them monitor their unhealthy lifestyle while encouraging healthier alternative options. The data that is collected includes their Body Mass Index, Blood Pressure, diet, and exercise amount. Using their coding skills, students will design projects to empower other young adults and children to make healthier lifestyle changes. Lastly, this tool will be used to help medical personnel better monitor their patient's health through the development of a website to collect and analyze the data collected.

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# Where Did the Time Go? An Android-Based Phone Time Management App\*

## Student Poster Abstract

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Recent data shows most people, on average, spend 3 hours and 15 minutes on our phones, and the top 20% of smartphone users have daily screen time in excess of 4.5 hours. During COVID-19, screen time surges due to lockdown and school closures, and that is taking a serious toll on our productivity and mental and physical well-being. Recent research shows that after 1 hour/day of use, more hours of daily screen time were associated with lower psychological well-being, including less curiosity, lower self-control, more distractibility, more difficulty making friends, less emotional stability, being more difficult to care for, and inability to finish tasks. Children are especially vulnerable to the negative effects of excessive screen time, and youth who spend the most time with screen media are most prone to depression, behavior problems, low self-esteem and poor physical fitness. Often people are unaware of the amount of their screen time. We created an Android app that is able to track and visualize phone time usage patterns and statistics to help user establish awareness of how much and in what patterns they use their Android devices. For example, the app tracks and visualize phone-level and app-level device usage, the number of times the user picks up the device, notifications from various apps, as well as the how the device usage is distributed in various categories of apps, etc. Compared with currently existing screen time apps, such as Apple's ScreenTime and Google's new Digital Wellbeing, our app is able to not only track mobile device usage, but also provide screen time goal management and mechanisms to encourage off-device time.

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# Resolving Dark Web Identities\*

## Student Poster Abstract

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Criminals continue to pose a significant threat on the dark web; a threat that will continue for decades. As cybersecurity professionals, we often hear and read about many forms of breached data for sale on the dark web yet we seldom learn how to properly resolve the identities of these criminals. Just having awareness of data breaches, sales, and/or knowledge of an uncontrolled release of information is not enough to adequately diagnose, fix, and prevent these problems from happening again. Therefore, it is important to quickly identify and expose these bad actors using the same hidden networks they use for exploitation and extortion. My research will attempt to offer a solution to these problems by investigating several multi-faceted strategies to identify, analyze, and expose criminal dark web identities.

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# A Template for Useful Proof of Work\*

## Student Poster Abstract

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Cryptocurrencies and numerous other dispersed frameworks use agreement calculations so as to accomplish concession to information. The calculation utilized by Bitcoin and numerous different cryptographic forms of money for this design is known as Proof of Work (PoW). A PoW algorithm typically demands that a large amount of computing power be used to solve an easily verifiable problem. Current implementations of Proof of Work entail vast quantities of energy consumption, where the bulk of this energy is expended exclusively on consensus-building. Our aim is not to minimize energy consumption directly, but to make it possible for Proof of Work to produce more useful and pragmatic computation, so that energy is saved by not running these computational tasks separately. We are building a template for proof of work protocols in our study, such that if followed, a protocol with similar security guarantees can be assured as the proof of work found in Bitcoin. Secondly, we also develop “useful” prototypes based on this template. Our approach is not to directly decrease energy consumption, but rather to make less waste from such consumption.

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