Research Topics in Computer Science

Objectives:

Research a IB CS topic and prepare resources that demonstrate understanding of a selected topic and its connections to other technology topics as well as its connections to the social and ethical applications of technology. During this research project student will

1. Know and understand:
   a. relevant facts and concepts
   b. appropriate methods and techniques
   c. computer science terminology
   d.methods of presenting information.
2. Apply and use:
   a.relevant facts and concepts
   b.relevant design methods and techniques
   c. terminology to communicate effectively
   d.appropriate communication methods to present information.
3. Construct, analyse, evaluate and formulate:
   a. success criteria, solution specifications including task outlines, designs and test plans
   b. appropriate techniques within a specified solution.
4. Demonstrate the personal skills of cooperation and perseverance as well as appropriate technical skills for effective problem-solving in developing a specified product.

Requirements

Working individually, students will select, investigate, and report one of the following topics. Students will answer basic questions to provide background information about the topic, appropriately citing credible sources, and explain the social, moral, ethical implications of the technology.

Students will prepare a written report and a web page, and prepare and deliver a presentation using PowerPoint.

<u>Schedule of Deliverables:</u>

Select topic	Friday May 20, 8:00 pm Email must be received by 8:00 pm or a topic will be assigned to you. Notifications will be sent out by 9:00 pm by email
Start Date	Friday May 20
Written Report Draft	Friday May 27 (or earlier so you can get feedback sooner)
Written Report	Thursday June 2 Hard copy due 11:30 am Electronic copy due 8::00 p.m.
Web page	Friday June 3, 9:00 PM Electronic delivery in tar format
Presentation Date	Tuesday June 7 a. Oral presentation with a PowerPoint presentation. b. one-page handout, 10 copies c. Electronic delivery of PowerPoint and one-page presentation due by 10:00 p.m.

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Topic Selection

Topic	**Big Data**
Student	
Required Vocabulary/Concepts	• What is meant by Big Data? • How is this a relatively new idea? • How is Big Data different from other data? • How is Big Data processed differently that other data?

Topic	**Software as a Service (SaS)**
Student	
Required Vocabulary/Concepts	• What is meant by Software as as Service? • What are the drawbacks of SaS? • What are the benefits of SaS? • What are some of the considerations for making SaS decisions? When would it be a good decision to use SaS and when would SaS not be a wise decision?

Topic	**Global Positioning Systems**
Student	
Required Vocabulary/Concepts	• What is meant by GPS? • Where is a GPS used? • How can a GPS system can identify the position of a person? • What are the ethical/social concerns of GPS technology? • What is GNSS?

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Topic	**Short-Range Networks**
Student	
Background	There is a sharp rise in payment systems that use short-range technology to process payments, such as making an in-store payment using an cell phone. This topic should research some of the common technologies and compare and contrast them.
Required Vocabulary/Concepts	• What is meant by Near Field Communication (NFC)? • What is Bluetooth? • What QE codes? • What is RFID? • What are the key differences between using QR codes or NFC, Bluetooth, or RFID for processing transactions? • What are the security risks of these technologies? • What are the ethical/social implications of these technologies?

Topic	**Cloud Computing**
Student	**Noah**
Required Vocabulary/Concepts	• Describe how cloud computing is different from a client-server architecture • difference/advantages/disadvantage of using private cloud for storing company data instead of storing data on their own server • Security issues of cloud computing • Discuss how cloud computing could potentially conflict with privacy

Topic	**Data Warehousing**
Student	**Hugo**
Required Vocabulary/Concepts	• Define the term data warehouse • Describe a range of situations suitable for data warehousing, and how this would fit into the SDLC • Explain why data warehousing is time dependent • Describe the advantages of using data warehousing

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Topic	**The Internet of Things**
Student	
Required Vocabulary/Concepts	• What is meant by the Internet of Things? • What products and companies are involved with the Internet of Things? • What standards and protocols are associated with the Internet of Things?

Topic	**Visualization**
Student	**Floney**
Required Vocabulary/Concepts	• Define the term visualization. • Identify a two-dimensional use of visualization. • Identify a three-dimensional use of visualization. • Discuss some of the related concepts of visualization, such as rendering, wire-framing, ray tracing, lighting, key frame, mapping, texture. • You may discuss the computer resources needed for visualization, or applications in automation, or an area of visualization that you find interesting.

Topic	**Encryption/decryption**
Student	**Vera**
Required Vocabulary/Concepts	• brute-force decryption • public-key, private-key • Describe how the SSL protocol involves the use of both symmetric and asymmetric encryption • uses of hardware encryption/decryption, software encryption/decryption (or both)

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Topic	**File Compression**
Student	
Required Vocabulary/Concepts	• lossless compression • lossy compression • differences for applications between lossless and lossy compression • What types of files can use lossy compression? • What types of files can not use lossy compression?

Topic	**Social Networking**
Student	**Sam**
Required Vocabulary/Concepts	• What are some of the characteristics of Web 2.0 • How has Web 2.0 facilitated the adaptation of Social Networking • How has Web 2.0 and Social Networking modified users' behavior

Topic	**Unwanted Software / Virus**
Student	
Warning	Be very careful when you research this topics, some of the easiest places to get unwanted software is from companies that want to sell you protection. Use only sites that you trust.
Required Vocabulary/Concepts	• What is Phishing • What is the difference between a virus, malware, adware • What is a Man-in-the-Browser attack • What is a keylogger? • What is spyware? • What are worms? • What is meant by bot? • What are the tools of cyber criminals • What is a back-door • What are some of the steps a user can do to protect their computing devices? • What are some of the steps a user can do to protect their personal data?

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Topic	**neural networks**
Student	
Required Vocabulary/Concepts	• Define/describe what a neural network is • Describe how it is used in predictive modeling (or another application that you find interesting) • Outline the function of hidden units and weights in neural networks • Compare and contrast the use of neural networks in speech recognition with their use in optical character recognition.

Topic	**Computer Security**
Student	**Yifan**
Required Vocabulary/Concepts	• What are the trade-offs between security and usability? • What is meant by a Man-in-the-Browser attack? • How are Man-in-the-Brower attacks carried out? • Highlight some recent computer security breaches (within the last one year) • Authentication • Identify and describe multiple methods of authentication • 2-factor / multi-factor authentication

Topic	**Internet Protocols and Standards**
Student	**Ramsey**
Required Vocabulary/Concepts	• What is a protocol? • How is a protocol different from a standard? • What is the Internet Protocol (IP) • What is TCP? • What is the importance of protocols on the web and on the Internet. • Discuss some of the protocols used this year, such as HTTP, HTTPS, Telnet/ssh, FTP

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For next year

Topic	**NoSQL**
Student	
Required Vocabulary/Concepts	• What is NoSQL • How is NoSQL different than using SQL • When is NoSQL a better solution than using SQL and the associated tools? • When does it make the most sense to use both NoSQL and SQL?
http://nosql-database.org/ https://www.thoughtworks.com/insights/blog/nosql-databases-overview	