Component 4:

Introduction to Computer Science

Component Guide

Health IT Workforce Curriculum
Version 4.0/Spring 2016

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Component Number: 4

Component Title:

Introduction to Computer Science

Component Description:

For students without an IT background, this component provides a basic overview of computer architecture; data organization, representation and structure; structure of programming languages; and networking and data communication. It also includes basic computing terminology.

Component Objectives:

At the completion of this component, the student will be able to:

1. Use correct terminology for computing and technology, including that for hardware, software, networks, the Internet, and databases.
2. Identify commonly used hardware components.
3. Identify commonly used operating systems and software applications.
4. Explain the purpose and principles of programming languages and identify commonly used languages.
5. Define a database, explain what querying languages are, and identify commonly used database systems.
6. Describe network computing, including its risks and benefits, and identify commonly used communication hardware and software components.
7. Discuss security risks and potential solutions.
8. Explain the design and development process of an information system, such as software.

Component Files

Each unit within the component includes the following files:

- Lectures (voiceover PowerPoint in .mp4 format); PowerPoint slides (Microsoft PowerPoint format), lecture transcripts (Microsoft Word format); and audio files (.mp3 format) for each lecture.
- Application activities (discussion questions, assignments, or projects) with answer keys.
- Self-assessment questions with answer keys based on identified learning objectives.
- Some units may also include additional materials as noted in this document.

Component Units with Objectives and Topics

Unit 1: Basic Computing Concepts, Including History

Description:

This unit introduces basic computing concepts and terminology. It identifies common elements of computers, both in terms of hardware and software and provides guidance on computer selection by discussing the range of computer types, from desktops to laptops to servers. Finally, it provides a history of the development of computing and health care information systems.

Objectives:

1. Define what a computer is.
2. Describe different types of computers, including PCs, mobile devices, and embedded computers.
3. Define the common elements of computer systems.
4. Describe typical hardware and software options for desktop, laptop, and server systems for home and business use with an emphasis on health care systems.
5. Explain the development of computers and the Internet, including health care systems, up to the present time.

Lectures:

a. Definitions, Descriptions, and Elements (16:13)

b. Selecting a New Computer (20:56)

c. History of Computers (21:33)

d. The Growth of Personal Computers and the Internet (24:05)

Suggested Readings

Knapp, M. (2016, April 26). 9 Key Things to Know Before You Buy a New Computer. *The Cheat Sheet.* Retrieved from http://www.cheatsheet.com/technology/9-tips-for-picking-your-machine-computer-shopping-cheat-sheet.html/?a=viewall.

Paris, C. (2014, May 12). 5 categories of computer types and components [Blog post]. Retrieved from https://blog.udemy.com/categories-of-computer/.

Unit 2: Computer Hardware

Description:

This unit provides a foundation on computer functioning, data representation, input and output devices, and the CPU and its role in system functionality.

Objectives:

1. Describe the major components of a computer system.
2. Provide examples of input and output devices used in health care.
3. Discuss primary and secondary storage devices.
4. Introduce binary notation and describe data representation, storage, and manipulation in binary format.
5. Introduce data types and explain how different data types are stored and addressed.
6. Describe the functionality of the central processing unit (CPU).
7. Provide examples of CPUs designed for health care applications.

Lectures:

a. Components and Peripherals (12:50)

b. Ports, Memory, and Secondary Storage (13:51)

c. Data Types, Data Addresses, and the CPU (10:39)

Suggested Readings

Central processing unit. (n.d.). In *Wikipedia*. Retrieved August 31, 2016, from https://en.wikipedia.org/wiki/Central_processing_unit.

Corey. (2016, March 4). How to Build a Gaming PC 2016 – Step by Step Guide to Choosing Your Hardware [Blog post]. Retrieved from http://newbcomputerbuild.com/newb-computer-build/how-to-build-a-gaming-pc-2016-step-by-step-guide/.

Hock-Chuan, C. (n.d.). A Tutorial on Data Representation: Integers, Floating-point Numbers, and Characters [Teaching notes]. Retrieved August 31, 2016, from: https://www.ntu.edu.sg/home/ehchua/programming/java/DataRepresentation.html.

Lin, C. (2003, March 12). ASCII vs. Binary Files [Online lecture notes]. Retrieved from: https://www.cs.umd.edu/class/sum2003/cmsc311/Notes/BitOp/asciiBin.html.

Unit 3: Computer Software

Description:

This unit covers application and system software, with a focus on health care systems. It describes the functions of an operating system, presents different operating systems, and defines the purpose and usage of file systems.

Objectives:

1. Define computer software and major software types.
2. Describe application software classification and provide examples, including those focused on health care.
3. Define what an operating system (OS) is.
4. Explain the features and functions of operating systems.
5. Classify operating systems.
6. Describe commonly used operating systems.
7. Describe types and major attributes of files.
8. Explain the purpose of file systems.
9. Provide file management tips.
10. Identify different implementations of file systems.

Lectures:

a. Identify major classifications of software (15:34)

b. What an operating system is and what it does (14:12)

c. Files and file management (8:38)

d. Files and file management (13:03)

Suggested Readings

List of open-source health software. (n.d.). In *Wikipedia*. Retrieved August 31, 2016, from https://en.wikipedia.org/wiki/List_of_open-source_health_software.

Thakur, D. (n.d.). What is software? Characteristics and Classification of Software. In *Computer Notes*. http://ecomputernotes.com/software-engineering/characteristics-and-classification-of-software.

Understanding operating systems. (n.d.). In *Tutorial: Computer Basics* [Online tutorial]. Retrieved from http://www.gcflearnfree.org/computerbasics/understanding-operating-systems/1/.

Unit 4: Computer Programming

Description:

This unit discusses the purpose and types of programming languages, from simple machine code to high level programming languages. It explains interpretation and compilation, and introduces basic elements of a programming language: variables, assignment statements, expressions, loops, and conditional statements. Finally, this unit presents some advanced programming concepts such as inheritance, modularity, encapsulation, and object oriented programming.

Objectives:

1. Define the purpose of programming languages.
2. Differentiate between the different types of programming languages and list commonly used ones.
3. Explain the compiling and interpreting process for computer programs.
4. Learn basic programming concepts including variable declarations, assignment statements, expressions, conditional statements, and loops.
5. Describe advanced programming concepts including objects and modularity.

Lectures:

a. Programming Languages (18:08)

b. Compiling and Interpreting Process for Computer Programs (06:41)

c. Programming Language Constructs (18:53)

d. Basic Programming Concepts (16:24)

e. Advanced Programming Concepts (12:38)

Suggested Readings

Bouwkamp, K. (2016, January 27). The 9 Most In-Demand Programming Languages of 2016 [Blog post]. Retrieved from http://www.codingdojo.com/blog/9-most-in-demand-programming-languages-of-2016/.

Hemmendinger, D. (n.d.). Computer programming language. In *Encyclopedia Britannica*. Retrieved August 31, 2016, from https://www.britannica.com/technology/computer-programming-language.

Holowczak, R. (n.d.). Programming concepts: A brief tutorial for new programmers [Online tutorial], pp. 1-8. Retrieved from http://holowczak.com/programming-concepts-tutorial-programmers/.

The Java™ Tutorials. (n.d.). Retrieved from https://docs.oracle.com/javase/tutorial/.

Additional Materials

This unit contains the following additional files:

- Comp4_unit4_BMI_Coding.docx
- Comp4_unit4_BMI_using_nested_if.docx
- Comp4_unit4_java_resources.docx

Unit 5: Databases and SQL

Description:

This unit discusses the purposes of databases, relational databases, and the querying language SQL. Students will design a simple database using data modeling and normalization. This unit defines basic data operations, provides guidance on how to create common query statements, and discusses SQL implementation.

Objectives:

1. Define and describe the purpose of databases.
2. Define a relational database.
3. Describe data modeling and normalization.
4. Describe the structured query language (SQL).
5. Define the basic data operations for relational databases and how to implement them in SQL.
6. Design a simple relational database and create corresponding SQL commands.
7. Examine the structure of a health care database component.

Lectures:

a. How Databases Store Data (11:28)

b. Data Modeling and Normalization (09:44)

c. Structured Query Language (13:45)

d. Structure of a Health Care Database (10:23)

Suggested Readings

Databases [Tutorial directory]. (n.d.). Retrieved from http://www.quackit.com/database/.

Introduction to databases [Online video tutorial]. (n.d.). Retrieved from https://thenewboston.com/videos.php?cat=49.

SQL tutorial. (n.d.). Retrieved August 31, 2016, from http://sqlzoo.net/.

Unit 6: Networks

Description:

This unit covers the history, evolution, and variety of computer networks. It provides an introduction to network addressing, network topologies, standards and protocols, logical model concepts, network hardware, and wireless communication.

Objectives:

1. Define what a communication network is.

2. Explain the purposes and benefits of a communication network.
3. Explain the Internet and World Wide Web (WWW), their histories, and their structures.
4. Describe different ways of connecting to the Internet.
5. Explain the basics of network addressing.
6. Introduce network classification by the coverage size.
7. Describe different network topologies.
8. Outline different standards and protocols that govern wired and wireless communications.
9. Describe the benefits and disadvantages of wireless communication.
10. Describe a typical wireless network setup.
11. Describe network hardware.
12. Introduce networking logical models and discuss the Open Systems Interconnection (OSI) model.

Lectures:

a. Introduction to Networks and the Internet (16:22)

b. Basics of Internet Addressing and Network Classification (15:20)

c. Network Topologies, Protocols, and Standards (12:40)

d. Wireless Communication and Network Hardware (18:50)

e. Networking Logical Models and the Open Systems Interconnection Model (12:50)

Suggested Readings

Computer networking tutorial. (n.d.). Retrieved from http://www.e-tutes.com/.

History of the internet. (n.d.). In *Wikipedia*. Retrieved August 31, 2016, from https://en.wikipedia.org/wiki/History_of_the_Internet.

ISO/OSI Model in Communication Networks [Online tutorial]. (n.d.). Retrieved from http://www.studytonight.com/computer-networks/complete-osi-model.

Unit 7: Security and Privacy

Description:

This unit covers common security concerns and safeguards, including firewalls, encryption, virus patterns, and protection software, as well as programming for security. Additional topics include security of wireless networks, and concerns, mitigations, and regulations related to health care applications.

Objectives:

1. Define cybercrime and cybersecurity.
2. List common information technology, or IT, security and privacy concerns.
3. List the hardware components that are usually attacked by hackers.
4. Explain some of the common methods of attack.
5. Describe common types of malware.
6. Explain social engineering methods used by cybercriminals.
7. Describe methods and tools available for protection against cyberattacks.
8. Describe practices designed to minimize the risk of successful cyberattack.
9. Address specifics of wireless device security.
10. Explain security and privacy concerns associated with Electronic Health Records (EHRs).
11. Describe security safeguards used for health care applications.
12. Provide the basics of ethical behavior online.

Lectures:

a. Cybercrime and IT Security (5:31)

b. Hackers Methods (15:59)

c. Protecting Against Cybercrime (12:20)

d. Minimizing Risk of a Successful cyberattack (10:41)

e. Cybercrime and Electronic Health Records, including Ethical Online Behavior Concepts (15:35)

Suggested Readings

Elmblad, S. (n.d.). Compare Antivirus Software Reviews. *Consumer Affairs*. Retrieved August 31, 2016, from https://www.consumeraffairs.com/computers/antivirus-software/.

Hadnagy, C. (n.d.) The Official Social Engineering Portal - Security Through Education. Retrieved from http://www.social-engineer.org/.

Introduction to Network Security [Online tutorial]. (n.d.). (pp. 1-10). Retrieved from http://learnthat.com/introduction-to-network-security.

Unit 8: Information Systems

Description:

This unit defines information systems and describes how they are used. It discusses the design, development, testing, support, and maintenance of information systems. Finally,

it explains how information systems are used in health care settings, including the role of specialized information systems.

Objectives:

1. Define an information system, explain its purpose, and provide examples.
2. Describe the components of an information system.
3. Describe the process of information system development.
4. Introduce specialized information systems.
5. Explain how information systems are used in health care.

Lectures:

a. What is an Information System? (20:17)

b. The Systems Development Process (24:10)

c. Specialized Information Systems (17:06)

Suggested Readings

Health informatics. (n.d.). In *Wikipedia*. Retrieved August 31, 2016, from https://en.wikipedia.org/wiki/Health_informatics.

Information management. (n.d.). In *Wikipedia*. Retrieved August 31, 2016, from https://en.wikipedia.org/wiki/Information_management.

Lindsay, J. (n.d.). Information Systems: Fundamentals and Issues. Retrieved August 31, 2016, from http://www.oturn.net/isfi/.

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