THE UNIVERSITY OF ZAMBIA
SCHOOL OF NATURAL SCIENCES
DEPARTMENT OF COMPUTER SCIENCE
CSC2101 COMPUTER SYSTEMS
FINAL EXAM
Wednesday 4th July, 2018

Time: 09 - 12HRS
Duration: 3HRS
Venue: GLT

INSTRUCTIONS

- This paper has a total of SEVEN questions
- You must answer a total of FIVE(5) questions
  - Answer all the Questions in Section A
  - Choose any THREE(3) from Section B
- All questions carry equal marks (20 marks each)
- Clearly number all your answers
- Use the marks as a guide to the detail required in your answers while keeping your answers concise and relevant

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Section A - Answer all the questions in this section [40 marks]

Question 1 - [20 marks]

1. (a) (2 points) Maxwell is struggling to understand the difference between computer science and ICT. How would you explain these to him?

   (b) (6 points) Mwenzi is looking to design her own Operating System. What three(3) difficulties with OS design will she have to contend with?

   (c) (2 points) What is a network "protocol"?

   (d) (5 points) Describe what is meant by a management information system (MIS). Include in your answer one example of how an MIS can be used.

   (e) (3 points) A computer makes 95% of its memory accesses to cache memory with an access time of 10 ns, it makes 4.9% of its accesses to DRAM with a 50 ns access time, and it makes 0.1% of its accesses to a disk drive with a 4 ms access time. What is the average memory access time?

   (f) (2 points) Why do computers use binary arithmetic, instead of the conventional base-10 arithmetic that people use?

Question 2 - [20 marks]

2. (a) Differentiate between the following devices:
      i. (2 points) Switch
      ii. (2 points) Router
      iii. (2 points) Hub

   (b) (6 points) Define three functional groups into which bus lines can be classified and state the significance of each classification width.

   (c) (3 points) Define the role of a firewall and draw a diagram that shows where a firewall should be positioned with relation to protecting a local network. In defining the role of a firewall, you should discuss the techniques that a firewall uses at different levels to prevent external attacks on the network and control traffic flow through the firewall.

   (d) (3 points) What is the role of the transport layer in the 5 layer TCP/IP protocol stack?

   (e) (2 points) What is the purpose of a MAC address?

Section B - Answer any three (3) Questions [60 marks]

Question 3 - [20 marks]

3. (a) The lexical- (scanner), syntactic- (parser), and semantic-analysis phases of a compiler front-end each process parts of the source program in particular ways and also check certain rules of the language being compiled.
   For each of the following possible language rules, specify which phase of the compiler should verify that a program conforms to that rule and why that part of the compiler is the best place for that check. If a check could be done equally well in more than one phase of the compiler, briefly discuss the tradeoffs between the alternative implementations. Keep your answers short and to the point.
      i. (4 points) A function is called with the correct number of arguments.
      ii. (4 points) Underscore characters (_) may appear in the middle of identifiers, but not at the beginning or end (i.e., this_identifier is legal, but_this_one is not).
      iii. (4 points) Every variable must be declared before it is used in the program (the classic C or Pascal rule).
      iv. (4 points) Assignment statements must end with a semicolon (;).

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(b) (4 points) Outline FOUR methods to protect computer resources against cyber attacks.

Question 4 - [20 marks]

4. (a) Write short paragraphs on the following;
   i. (4 points) Object oriented programing paradigm giving two (2) examples
   ii. (4 points) Functional programming paradigm giving two (2) examples
   iii. (2 points) Polymorphism
   iv. (2 points) Pass by value

   (b) (3 points) What is ICMP? Briefly explain the key areas of functionality for ICMP giving an example.

   (c) (2 points) What is the difference between the memory bus and the PCI bus?

   (d) (3 points) State THREE (3) components of a computer located outside of the CPU/Processor.

Question 5 - [20 marks]

5. (a) Briefly explain each of the following networking terms:
   i. (4 points) FTP
   ii. (4 points) SMTP
   iii. (4 points) POP

   (b) (8 points) Describe the factors which make a good or a poor MIS using examples to illustrate your answer.

Question 6 - [20 marks]

6. (a) (8 points) Draw the block diagram of a computer's CPU at the level of registers, buses, and functional units. Your diagram must include a Program Counter, PC.

   (b) (4 points) What is the purpose of a Program Counter (PC) in a computer?

   (c) (8 points) Starting with the Program Counter (PC), explain how an instruction is fetched and executed.

Question 7 - [20 marks]

7. (a) A computer system has a wide variety of memory systems from cache to optical storage and to magnetic tape. Each of these memory systems has its own characteristic, such as speed, bit-size, cost-per-bit, and so on
   i. (5 points) Explain why computers implement such a wide range of memory technologies.
   ii. (8 points) Briefly describe the basic operating principles and characteristics of any FOUR memory technologies.
   iii. (2 points) What trends do you expect to see in memory technology over the next few years?

   (b) (5 points) Briefly explain the difference between the OSI reference model and the TCP/IP reference model used to implement the Internet.

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