BSc (Hons) in Computer Science – 19.2/20.1
2nd Year 2nd Semester Examination
Model Paper
CS202.3 – Systems Fundamentals

Instructions to Candidates

1) Answer any 5 Questions
2) **The duration of the question paper is 5 hours. Including half an hour to download the paper and upload your answers in a single file**. (Note: **No email submissions are accepted under any condition.)**
3) Weightage of Examination: 50% out of final grade
4) Download the paper, provide answers to the selected questions in a word document.
5) Please upload the document with answers (Answer Script) to the submission link before the submission link expires
6) Answer script should be uploaded in PDF Format
7) Under any circumstances E-mail submissions would not be taken into consideration for marking. Incomplete attempt would be counted as a MISSED ATTEMPT.
8) The Naming convention of the answer script – Module Code_Subject name_Index No
9) You must adhere to the online examination guidelines when submitting the answer script to N-Learn.
10) Your answers will be subjected to Turnitin similarity check, hence, direct copying and pasting from internet sources, friend's answers etc. will be penalized.

Question 1

a) List eight ideas in Computer Architecture discussed in the module and briefly describe 2 ideas highlighting the contribution of the concepts for the evolution of the computer architecture.

[8 Marks]

b) List 2 measures of the computer performance and briefly describe the effect of hardware parallelism on the performance measures.

[4 Marks]

c) What is the purpose of defining memory hierarchy in computer architecture? Describe how the memory hierarchy supports the performance of the computer systems highlighting the speed and capacity of the elements in the memory hierarchy.

[8 Marks]

Question 2

a) Briefly describe the limitations of the early computer systems which were build on electro-mechanical components and basic electronic circuits.

[4 Marks]

b) Describe how the invention of transistors effects the enhancement of the computer performance.

[4 Marks]

c) Basic gates are the micro components in computer circuits.

   i. What gate circuits are considers as the universal gates? Justify the use of the term 'Universal gates' for the circuits listed above referring suitable examples and illustrations.

   [6 Marks]

   ii. You are requested to build a 2 bit comparator circuit using logic gates. Draw the circuit diagram of a comparator circuit with required components and prove the functionality referring to a suitable input stream.

   [6 Marks]

Question 3

In computer architecture, Amdahl's law gives the theoretical speedup in latency of the execution of a task at fixed workload that can be expected of a system whose resources are improved.

a) List the multiple levels of parallelism and describe one parallelism technique referring to a suitable example.

[6 Marks]

b) State the Amdahl's law and identify each component of the formula referring to a **suitable example**.

[4 Marks]

c) Briefly explain why the speed up received from Amdahl's law is considered as the 'maximum theoretical speedup'.

[4 Marks]

d) Assume 10% of the runtime of a program is not parallelizable. This program is to be run on 20 cores of a Intel Xeon Phi and on 40 cores of Nvidia GPU server to compare the speedup. Under the assumption that the program runs at the same speed on all of those cores, and there are no additional overheads, compare the speedup and comment on the cost factor with the speedup achievements.

[6 Marks]

Question 4

A "process" is a running instance of the program.

a) Comment on the above statement elaborating the relationship of the program and its process.

[3 Marks]

b) Briefly describe how process is initiated from a program highlighting the process creation mechanisms and requirements for the initiation.

[4 Marks]

c) Briefly illustrate how a process created by a running process by calling a system call referring to a suitable example.

[4 Marks]

d) A program required to be developed to print 5000 lines of "Printed Done". Develop a simple C program to print required number of lines which uses concurrent programming techniques. Providing a logically correct code will be accepted even it has some compilation errors.

[6 Marks]

e) Propose a mechanism to measure the performance by means of response time for the above program when it is developed with and without parallelism.

[3 Marks]

Question 5

When a process executes. It passes through different states. It is required to maintain unique information relevant to each running process and PCB is used to store relevant information

a) Identify the main states in the process life cycle and briefly describe the reasons behind the state changes of the process.

[5 Marks]

b) Briefly explain how PCB maintain the details of each process and how it is used when process changes the state.

[4 Marks]

c) Discuss the advantages and disadvantages in using subprocesses over multi-threads for each browser window.

[5 Marks]

d) What is concurrent computing? Compare concurrent computing with parallelism highlighting the performance and the overheads.

[6 Marks]

-END OF THE PAPER-