



NATIONAL SCHOOL OF BUSINESS MANAGEMENT

BSc (Honours) in Computer Science (NSBM)– 19.2/20.1

Year 02 Semester 02 Examination

29th October 2021

CS202.3 – Systems Fundamentals

Instructions to Candidates

- 1) Answer any 05 Questions
- 2) **Time allocated for the examination is five (05) hours (Including downloading and uploading time).** (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

Moore's law and Abstraction are two main concepts which energize the evolution of general-purpose computer systems.

- a) Briefly explain how the Moore's Law contributed to high utilization of computer systems for day today activities.
[5 Marks]
- b) Briefly describe the technical limitations of increasing the transistor dense infinitely to achieve very high speed for computations.
[5 Marks]
- c) What is 'Abstraction' with reference to computer science? Briefly explain how the concept of 'Abstraction' supported the development of computer system referring to a suitable example.
[6 Marks]
- d) List 2 examples in current computer systems which utilized the concept of redundancy to enhance the dependability of the system.
[4 Marks]

Question 2

- a) State the main concepts in 'Von Neumann' Architecture and briefly describe how the concept is achieved with its main components.
[5 Marks]
- b) Briefly explain how memory hierarchy is supported to eliminate the speed limitation in the 'Von Neumann' architecture.
[5 Marks]
- c) In Instruction Set Architecture (ISA), an instruction is defined with the opcodes and operands.
 - a. Identify 'Opcode' and 'Operand' referring to a suitable instruction.
[3 Marks]
 - b. List three the parameters defined in ISA for each 'Opcode' and the 'Operand'.
[3 Marks]
- d) How interpreter different from compiler in converting high level codes? Briefly explain why the source code is not required to run the program when a compiler is used to generate the machine code of it.
[4 Marks]

Question 3

Transistors are considered as the main component in logic circuits.

- a) Briefly explain how the introduction of transistors supported the performance enhancement of the computer systems.
[4 Marks]
 - b) List 3 basic logic gates and illustrate how transistor(s) can be used to implement basic logic gates.
[5 Marks]
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- c) What are sequential logic circuits? Briefly explain how it is different from combinational logic circuits.
[3 Marks]
- d) Comparators are used to compare bit streams. Draw a circuit diagram with XOR gates of a comparator which can be used to compare words with 3 bits. Justify your circuit using relevant truth table.
[8 Marks]

Question 4

Execution time is one of the measures of the performance of a CPU.

- a) Define the parameters of a program and the CPU which are used in calculating the execution time and state the formula for the execution time of the program.
[4 Marks]
- b) Why CPI of a program is normally defined as an 'Average CPI'? Briefly explain how the average CPI is calculated for a given program with 'n' number of instructions executed in 'c' number of clock cycles.
[4 Marks]
- c) A program is executed in a CPU with the clock rate of 2GHz and the ISA has defined 3 clock cycles for ALU instruction and 2 clock cycles for Jump/branch instruction. If the program consists with 200 million ALU instructions and 100 million branch instructions, calculate the execution time for the program which executed as a sequential process.
[6 Marks]
- d) If the clock cycles for ALU instruction is reduced to 2 clock cycles through an improved architectural design, calculate the new execution time for the same program and derive the speed up of the CPU after the improvement.
[6 Marks]

Question 5

In a computer system there are several processes initiated at a given time and they are in different states.

- a) Define the main states of a process and briefly explain the factors affecting for the state transition of the process.
[6 Marks]
- b) What is a process control block (PCB) and briefly explain how PCB used for the proper execution of a process.
[4 Marks]
- c) New browser application is in the designing stage and as the application architect, you have been asked to propose a suitable architecture for manage different tasks in the application. Referring your knowledge on processes and threads, propose the architecture of the new browser including justifications for the proposed design.
[10 Marks]

Question 6

- a) What is process scheduling? Briefly explain the value of process scheduling for the performance enhancement of the system discussing how the objectives are achieved referring to suitable examples.

[6 Marks]

- b) List 2 preemptive scheduling algorithms used in scheduling and briefly explain how preemptive scheduling is important to reduce the average waiting time.

[4 Marks]

- c) Following processes are to be executed by a single processor and the details of the processes are given in the table.

Process	Arrival Time	Execution Time
P1	0	5
P2	2	3
P3	5	6
P4	7	3

Calculate the 'Average waiting time' for the processes when using a *non-preemptive scheduling algorithm* and a *preemptive scheduling algorithm* with a quantum of 3. You can select any algorithm in each type. Please clearly indicate the names of the algorithms you selected for the calculations.

[5x2 Marks]

-END OF THE PAPER-