

North East University Bangladesh (NEUB)
Department of Computer Science and Engineering
Semester Final Examination, Spring 2022
Course code: **CSE-311** (Computer Architecture)
Total Marks: **40** | Time: 2 Hours

Answer any 4 questions.

- ✓ **Q1** (a) What do you mean by Program Counter (PC)? 2
(b) Mention 5 stages to execute an MIPS instruction. Describe the main jobs of each stage. 5
(c) Why a Single-Cycle Implementation Is Not Used Today? What are the advantages of pipelined Datapath? 3
- Q2** (a) What is an ALU? Design a 1-bit ALU. 4
(b) Using 1-bit ALU, design a 32-bit ALU that can perform (A **AND** B), (A **OR** B), $A + B$, $A - B$, $A == B$, $A < B$, where A and B is 32-bit numbers. 6
[Hint: draw the block diagram]
- ✓ **Q3** (a) What do you mean by i) virtual memory ii) cache? Draw the diagram to illustrate Memory hierarchy. 4
~~(b) What do you mean by page fault? Consider the following reference string of a process where four frames are allocated for this process:~~ 6
 $7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1$
How many page faults occur if we use the following page replacement algorithms i) FIFO ii) LRU
- ✓ **Q4** (a) What do you mean by ISA and Microarchitecture? 2
(b) What do you mean by Datapath? How can we implement pipelined datapath from single-cycle datapath? 4
(c) Draw the block diagram of the pipelined Datapath. 4
- Q5** (a) Add the numbers **0.5** and **-0.4375** in binary using the binary floating point add algorithm. 5
(b) Consider a 5-stage instruction execution in which each stage needs 100ps. If we execute 8 instructions, calculate the required execution time for non-pipelined and pipelined datapath. What is the speedup factor of pipelined execution? 5
- Q6** (a) What is pipeline hazard? Explain data hazard with an example. 5
(b) Describe the following techniques with proper diagrams. 5
- Pipeline Stall
 - Reordering Code
 - Forwarding