Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (CSE)/SEM-2/MCSE-202/2010

2010

ADVANCED COMPUTER ARCHITECTURE

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : 4 × 1 = 4

   i) Multi-core processors are essentially

      a) SIMD b) MIMD

      c) both SIMD and MIMD d) none of these.

   ii) Which of the following is not true about Thread Level Parallelism (TLP) ?

      a) Server can serve each client in a separate thread

      b) Multi-core architectures explicitly exploit TLP

      c) Single-core superscalar processors can fully exploit TLP

      d) A computer game can do AI, graphics and physics in three separate threads.

iii) Which of the following is not true about SIMD ?

a) On a memory access, all active processors must access the *same location* in their local memory

b) All active processors execute the same instruction synchronously, but on different data

c) Consists of two types of processors

d) All the processing elements (PEs) execute in parallel and none of the units can be allowed to skip any particular instruction.

iv) In distributed memory machines

a) processors communicate by passing messages to each other

b) coordination of accesses to locations done by use of locks provided by thread libraries

c) memory is globally shared; therefore processes (threads) see single address space

d) each processor has it own local memory which can be accessed by others at times.

GROUP – B

(Short Answer Type Questions)

Answer *all* the following questions. $2 \times 5 = 10$

2. Flynn's taxonomy grouped computer architectures into four types on the basis of their instruction and data stream. What are they ? Describe each of them.

3. Write short notes on Grid and Cloud computing. Discuss the concept of virtualization in this context.

GROUP – C

(Long Answer Type Questions)

Answer any *four* of the following. 4 × 14 = 56

4. SIMD operations almost always use scalar arrays as input data. However, the data structure of these arrays is not always suited for SIMD operations. The built-in function vec_perm (va, vb, vpat) is used for vector realignment where *va* and *vb* are vectors and *vpat* is the realignment pattern.

   a) Explain with an example how this realignment works.

   b) Write an SIMD 4 × 4 matrix transpose program where each element of the matrix is 4 bytes long using vec_perm () function.

5. a) What is multi-core architecture ? Compare multi-core and simultaneous multithreading (SMT). Explain how the two can be combined to make programs run faster.

   b) Describe the cache coherence problem in multi-core architectures. Discuss the different techniques to solve it.

6. a) Answer the following questions given the following reservation table with a pipeline clock cycle τ = 20 ns.

X					*X*
	X		*X*		
		X			
			X	*X*	

   i) What are the forbidden latencies and the initial collision vector ?

   ii) Draw the state transition diagram for scheduling the pipeline.

   iii) Determine the MAL. 8

b) Suppose an operation can be subdivided into 6 sub-operations.

A 6-stage pipeline is implemented with the stages consuming the following execution times : 130, 90, 180, 100, 120 and 80 picoseconds. What is the clock period of the pipeline ?

Suppose pipelining introduces an overhead of 20 ps. What is the maximum speed-up achievable in this system ? 6

7. a) Describe the difference between RISC and CISC architectures. 4

b) Design a data path for MIPS architecture for

i) ADD/SUBTRACT

ii) LOAD/STORE instructions. 10

8. a) What is the difference between a vector processor and a parallel processor ? 3

b) Explain with diagram how a vector processor speeds up vector operation. 6

c) What is chaining and scatter/gather operation in Vector processor ? 5

9. a) What are the different types of data hazards encountered in pipelining ? 3

b) How are RAW hazards solved in pipelining ? 4

c) Explain with state diagram the technique of Dynamic Branch Prediction in pipelining. 7