Exam.Code:0999
Sub. Code: 7295

2074
M.E. (Computer Science and Engineering)
First Semester
Elective - II
CS-8109: Advanced Computer Architecture
(For UIET)

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.

x-x-x

Q1 Attempt the following questions. (2x5)

i) Briefly describe the Snoopy bus protocol.
ii) Explain computational granularity.
iii) Differentiate between CISC and RISC processor.
iv) Explain inclusion, coherence and locality properties.
v) Differentiate between Busy-wait and Sleep-wait protocols.

Section A

Q2.(a) Consider the interleaved execution of the four programs as follows on each of the three machines. Each program is executed in a particular mode with the measured MIPS rating.

Program	Execution Time (in seconds)		
	Computer A	Computer B	Computer C
Program 1	1	10	20
Program 2	1000	100	20
Program 3	500	1000	50
Program	100	800	100

i) Determine the arithmetic mean execution time per instruction for each machine executing the combined workload, assuming equal weights for the four programs.
ii) Determine the harmonic mean MIPS rate of each machine.
iii) Rank the machines based on the harmonic mean performance.

(b) A sequential program consists of the following five statements, S1 through S5. Considering each statement as a separate process, clearly identify input set I_i and output set O_i of each process. Restructure the program using Bernstein's conditions in order to achieve maximum parallelism between processes. If any pair of processes cannot be executed concurrently, specify which of the three conditions is not satisfied.

```
S1:   A = B + C
S2:   C = B + D
S3:   S = 0
S4:   Do I = A, 100
            S = S + X(I)
      End Do
S5:   IF (S > 1000) C = C x 2
```

Q3. (a) Explain and compare speedup performance models. (06+04)
(b) Discuss VLIW processors and various problems associated with the VLIW processor. Describe strategies for mitigating them.

Q4. (a) Consider that two 2×2 matrices X and Y are multiplied to compute the sum of the four elements in the resulting product matrix $Z = X \times Y$. There are eight multiplications and seven additions to be performed in this program, as written below: (05+05)

$$\begin{bmatrix} X_{11} & X_{12} \\ X_{21} & X_{22} \end{bmatrix} \times \begin{bmatrix} Y_{11} & Y_{12} \\ Y_{21} & Y_{22} \end{bmatrix} = \begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix}$$

Contd.....P/2

Based on above problem find out the following (Assume any data if missing)

i) Calculate grain size and communication latency.
ii) Draw its fine grain program graph.
iii) Show the scheduling of the fine grain program first on sequential uniprocessor (P1) and then on eight-processor (P1 to P8) system.
iv) Show the parallel scheduling after grain packing to reduce communication delays.

(b) Discuss memory hierarchy technology. (08+02)

Section B

Q5. (a) What is cache coherence problem and when do you say a memory system is coherent?
(b) Draw and explain 16x16 Omega Network. Explain its routing technique with example. (05+05)

Q6.(a) What are vector-access memory schemes? Compare the three memory organization.
(b) Draw and explain the CM-2 architecture. Explain in detail that how the nodes are processed in CM-2? (05+05)

Q7.(a) What are semaphores and their applications in parallel computing? Compare Binary and Counting semaphores.
(b) Differentiate between synchronous and asynchronous message-passing schemes. (05+05)

x-x-x