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MANIPAL INSTITUTE OF TECHNOLOGY

(Constituent Institute of Manipal University)

SIXTH SEMESTER B.TECH. (CSE) DEGREE MAKE UP EXAMINATION
JULY 2014
PARALLEL COMPUTER ARCHITECTURE AND PROGRAMMING(CSE 306)
DATE: 04-07-2014

TIME: 3 HOURS MAX.MARKS: 50

Instructions to Candidates

- Answer **any five** full questions.
- Missing data can be suitably assumed.

1A. Explain an array processor and a multiprocessor system with neat diagram.

1B. Show the instruction dependency and scheduling scheme for the following instructions which are done in Simultaneous Multithreading when 1 Floating point ALU and 3 Integer ALUs are available.

Instruction Stream A	Instruction Stream B
add a,b,c	add a,b,n
add d,b,c	fmul d,b,n
add f,a,d	mul g,h,a
mul g,d,h	add f,d,g
fmul k,g,f	fadd h,a,g
add m,g,k	add m,g,f

1C.An examination paper has 6 questions to be answered and there are 5000 answer books. Each answer takes 3 minutes to correct. If 3 teachers are employed to correct the papers in pipeline mode, how much time will be taken to complete the job of correcting 5000 answer papers? What is the efficiency of processing? The clock rate of the pipeline is 25MHZ.Calculate the throughput. (4+3+3)

2A. Write the difference between Static and Dynamic pipeline

2B. Consider the three staged pipeline processor specified by the following reservation table:

	1	2	3	4
S1	**X**			**X**
S2		**X**		
S3			**X**	

i) List the set of forbidden and permissible latencies and collision vector.

ii) Draw a state transition diagram showing all possible cycles without causing the collision in the pipeline.

iii) Identify all the simple cycles and greedy cycles from the transition diagram. What is the MAL of this pipeline? What is the efficiency of this pipeline?

iv) If pipeline clock period is 20ns find the throughput of this pipeline.

2C. List the 3 classes of Hazards. Find out the various data hazards in the following instruction stream. Also remove the hazards if possible.

I1: i=j-k;
I2: m=k+2;
I3: n=k+j;
I4: j=10;
I5: k=j+10;
I6: k=n/j;
I7: m=k-n; . (2+5+3)

3A. Write an MPI program to read two arrays A and B of size *n* in the root process(process 0). Using *m* process including the root (may or may not be equal to *n*) subtract the elements of array B from corresponding elements of array A to produce resultant array C and print it in the root process. Using *m* process find the number of Positives, Negatives and Zeros in the array C and print it in the root process. Write the program using Collective Communication routines.

3B. Briefly explain any one method of sending a message in Point to Point Communication with syntax and example.

3C. With a neat diagram explain the Memory Model used in OpenCL. (5+3+2)

4. (i) Write an OpenCL program to read a square matrix A of size *n*x*n*. The program should display the resultant matrix B of size *n*x*n* which is the transpose of matrix A(except the principal diagonal elements).If the index of the principal diagonal element of B is odd, then it is the sum of all the elements which are below the principal diagonal elements of A. If the index of the principal diagonal element of B is even, then it is the sum of all the elements which are above the principal diagonal elements of A.

(ii) Write the Kernel code for 4(i) which produces each element of the matrix B in parallel.

Example :

A =	1	**2**	**3**	**4**		B =	**28**	5	1	5
	5	6	**7**	**8**			2	26	2	6
	1	2	3	**4**			3	7	28	7
	5	6	7	8			4	8	4	26

(7+3)

5A. Find the sum of the numbers given below using an array of 8 PEs. Write the algorithm and the masking scheme for the same.

PE0	PE1	PE2	PE3	PE4	PE5	PE6	PE7
12	5	20	22	9	17	15	35

5B. Given 2 matrices

A = a11 a12 B = b11 b12
a21 a22 b21 b22

i. Show all parallel SIMD operations carried out in each of the PE

ii. Write the SIMD algorithm for matrix multiplication

5C. Sort the following numbers in descending order using odd-even transposition

PE0	PE1	PE2	PE3	PE4	PE5	PE6	PE7
21	19	34	12	5	16	92	87

(4+3+3)

6A. Explain the 2 classes of MIMD multiprocessors with diagrams.

6B. Explain with example cache coherence problem in multiprocessors. Explain the two methods under Snooping Protocol with example. (4+6)