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10CS74

Seventh Semester B.E. Degree Examination, Jan./Feb.2021
Advanced Computer Architecture

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define Instruction Set Architecture (ISA). Illustrate the seven dimensions of an ISA. **(08 Marks)**

b. State and explain Amdahl's law. Also represent speedup ratio. **(05 Marks)**

c. Find the die yield for dies that are 1.5 cm on a side and 1.0 cm on a side, assuming a defect density of 0.4 per cm^2 and α is 4. **(05 Marks)**

d. Define module reliability and availability. **(02 Marks)**

2 a. Define data hazard. Explain how to minimize data hazard stall by forwarding technique. **(07 Marks)**

b. List the four schemes used to reduce pipeline branch penalties. Illustrate delayed branch technique in detail. **(08 Marks)**

c. List and explain five different ways of classifying exceptions in a computer system. **(05 Marks)**

3 a. Illustrate the basic compiler techniques for exposing instruction level parallelism for the following code :

```
for (i = 1000; i > 0; i = i – 1)
X[i] = X[i] + S ;
```

(06 Marks)

b. Explain 2-bit dynamic branch prediction scheme with a state transition diagram. **(04 Marks)**

c. With a neat diagram, explain basic structure of a MIPS floating-point unit using Tomasulo's algorithm. Also define various fields of reservation station. **(10 Marks)**

4 a. Explain Branch Target Buffer (BTB), with a neat diagram. Also explain the steps involved in handling an instruction with a BTB. **(12 Marks)**

b. Explain in detail, the issues in implementing advanced techniques for speculation. **(08 Marks)**

PART – B

5 a. Explain the different taxonomy of parallel architecture proposed by Flynn. **(04 Marks)**

b. With a state transition diagram, explain a write invalidate, Cache Coherence Snooping Protocol for a write-back cache. **(10 Marks)**

c. Explain the basic hardware primitives to implement synchronization in multiprocessor architectures. **(06 Marks)**

6 a. Describe the six basic cache optimization techniques. **(10 Marks)**

b. Explain in detail the four common questions for the first level of the memory hierarchy. **(10 Marks)**

7 a. List the advanced optimization techniques of cache performance. Also explain in detail, compiler optimizations to reduce miss rate. **(10 Marks)**

b. With a block diagram, explain DRAM technology. **(05 Marks)**

c. Explain protection via virtual memory. **(05 Marks)**

8 a. Find all the true dependences, output dependences and antidependences and eliminate the output dependences and antidependences by renaming in the following code:

```
for (i = 1; i <=100 ; i = i + 1) {
    Y[i] = X[i] / C ;     /*S1*/
    X[i] = X[i] + C ;  /*S2*/
    Z[i] = Y[i] + C ;  /*S3*/
    Y[i] = C - Y[i] ;  /*S4*/
}
```

(08 Marks)

b. Explain software pipelining in detail. **(08 Marks)**

c. Explain predicated instructions. **(04 Marks)**

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