B.Sc. Engg. CSE 8th Semester

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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION **SUMMER SEMESTER, 2017-2018**

DURATION: 3 Hours **FULL MARKS: 150**

CSE 4803: Parallel and Distributed Processing

Programmable calculators are not allowed. Do not write anything on the question paper.

There are 8 (eight) questions. Answer any 6 (six) of them.

Figures in the right margin indicate marks.

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1. a) What is mounting? How a foreign name space can be mounted in a distributed system? Explain with the example of NFS. 7

   b) Why is an identifier more suitable than an address as a name for an object in a distributed system? Explain DNS name space distribution with an example. 3+7

   c) What is location-independent naming? How does the Chord algorithm support it? 8

2. a) What is parallel computing? Briefly describe the parallel computer memory architectures. 8

   b) A benchmark program containing 234,000 instructions is executed on a processor having a cycle time of 0.15ns. The statistics of the program is given below: 9

Table 1: Statistics of a program

Instruction Type	Instruction Mix	Processor Cycles	Memory Cycles
Arithmetic	58 %	2	2
Branch	33 %	3	1
Load/Store	9 %	3	2

Each memory reference requires 3 CPU cycles to complete. Calculate MIPS rate and throughput for the program.

   c) The degree of concurrency increases as the decomposition becomes finer in granularity. Justify your answer with an example. 8

3. a) Suppose there are three processes *A*, *B*, and *C*. All clock runs at the same rate but initially *A*'s clock reads 10, *B*'s clock reads 0 and *C*'s clock reads 5. At time 10 by *A*'s clock, *A* sends a message to *B*, this message takes 4 units of time to reach *B*. *B* then waits one unit of time and then sends a message onto *C* which takes 2 units of time to reach *C*. Assuming that the system implements Lamport's timestamps draw a picture illustrating the timestamps for the messages and explain how the timestamps are obtained. 7

   b) What is the advantage of vector clocks over Lamport clocks? Consider three processes p1, p2, and p3 with the following pattern of communication given in Figure 1. Label each event with a vector timestamp. 3+5

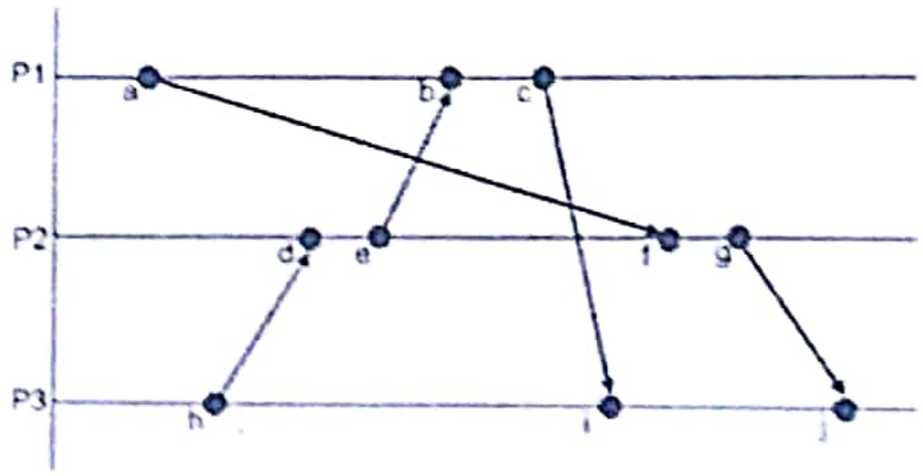

Figure 1: Four Processes P1, P2, P3 run events to send and receive messages.

c) What is mutual exclusion? Describe in detail how a distributed algorithm will work in a network of four nodes to achieve mutual exclusion. Calculate the messages per entry/exit and delay before entry. 2+5+3

4. a) Define data centric consistency and client centric consistency. Calculate numerical deviation and order deviation for replica A and B given in Figure 2. 3+4

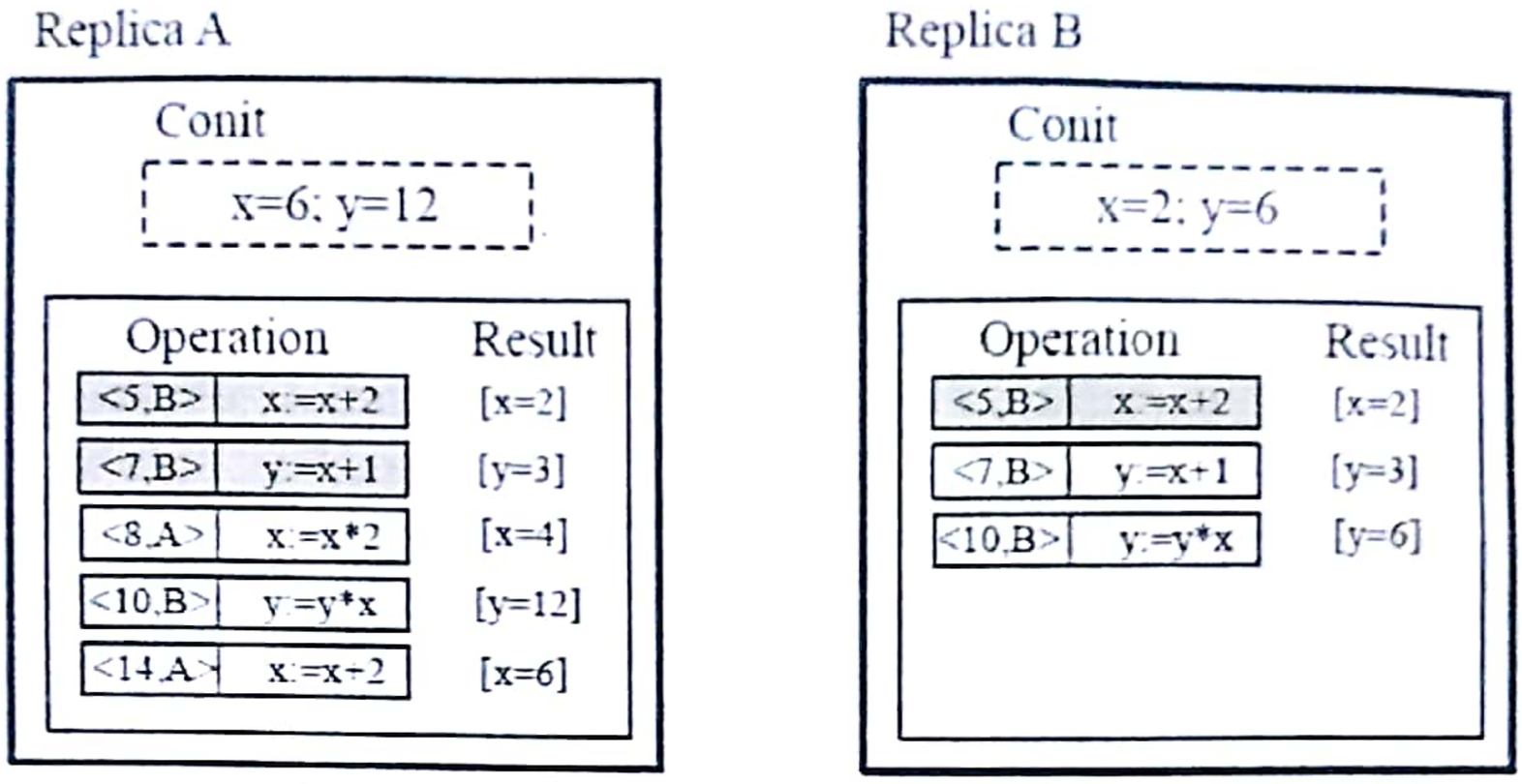

Figure 2: An example of keeping track of consistency deviations.

b) Define sequential-consistency and causal consistency. Is the following data store, given in Figure 3, sequentially consistent? Explain your answer. 4+4

A	W(x)a		W(x)b	
B		R(x)a	R(x)b	
C			R(x)b	R(x)a

Figure 3: for Question no 4.(b)

c) Consider a Web server that is placed in New York. Normally, this server can handle incoming requests quite easily, but it may happen that over a couple of days, a sudden burst of requests come in from an unexpected location far from the server. In that case, How the server will resolve it? Explain with example. 10

5. a) Consider the following sequence of instructions being processed on the pipelined 5-stage RISC processor: 6x3

```
Load R4, #100(R2)
Add R5, R2, R3
Subtract R6, R4, R5
And R7, R2, R5
```

i. Identify all the data dependencies in the above instruction sequence. For each dependency, indicate the two instructions and the register that causes the dependency.

ii. Assume that the pipeline does not use operand forwarding. Also, assume that the only sources of pipeline stalls are the data hazards. Draw a diagram that represents instruction flow through the pipeline during each clock cycle. How long does it take for the instruction sequence to complete?

iii. Now, assume that the pipeline uses operand forwarding. There are separate forwarding paths from the outputs of stage-3 and stage-4 to the input of stage-3. Draw a diagram that represents the flow of instructions through the pipeline during each clock cycle. Indicate operand forwarding by arrows.

b) What is dynamic branch prediction? Draw the finite state machine for a 2-bit prediction scheme. 2+5

a) "Pipelining does not result in individual instructions being executed faster; rather, it is the throughput that increases" Explain this with necessary example. 8

b) Define *The Owner Computes Rule*. Give an example of Mapping Technique for Minimum Idling 2+5

c) Do you think a compiler can solve data hazard? If so how? Justify your answer with an example. 5

d) Consider a web browser that returns an outdated cached page instead of a more recent one that had been updated at the server. In this a failure, and if so, what kind of failure? 5

7. a) Define *Cloud Computing*. Cloud computing can be viewed as a collection of services, which can be presented as a layered computing architecture. Briefly introduce the layered architecture of cloud computing. 10

b) Describe the data center interconnect network architectures for clouds. 8

c) Why PaaS and IaaS providers are often called the infrastructure providers or cloud providers? Explain. 7

8. a) What do the map and reduce phases do in the Map Reduce algorithm? Explain with proper example. 8

b) Write down the main purpose of Google File System (GFS). With proper diagram outline the architecture of the GFS with brief description of each components. 2+6

c) What is Lease and Mutation Order in GFS? Write the steps needed to append data in GFS. 3+6