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**University Examinations 2015/2016**

THIRD YEAR, FIRST SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE MATHEMATICS AND COMPUTER SCIENCE

**CIT 3229: OPERATING SYSTEMS II**

**DATE: NOVEMBER, 2015 TIME:** $2$**HOURS**

**INSTRUCTIONS:** *Answer question* ***one COMPULSORY*** *and any other* ***two*** *questions.*

**QUESTION ONE – (30 MARKS)**

1. Define the term distributed systems. (2 Marks)
2. Define the term real time system. (2 Marks)
3. Discuss the term Transparency as used in distributed system and explain at least three types of transparency. (4 Marks)
4. Concurrency is a key issue in design of distributed system. State four problems associated with Uncontrolled interleaving of sub-operations of concurrent transactions. (4 Marks)
5. Cloud computing services like Amazon’s EC2 assign users virtual machines (VMs) instead of allocating physical machines directly. Doing so provides at least three major benefits to Amazon. Explain what these three benefits are, giving a brief motivation for each one.

 (3 Marks)

1. Give an example of a distributed system. Explain why it is distributed and what advantage over non-distributed implementation of the same system. (4 Marks)
2. Why is it difficult to synchronize things in distributed systems. (1 Mark)
3. Differentiate between monolithic and micro-kernel. (2 Marks)
4. It is difficult for distributed systems to determine up-to-date global state, discuss three reasons why? (3 Marks)
5. Differentiate between strict real time system and hard real time system. (3 Marks)
6. Define the term virtual memory. (2 Marks)

**QUESTION TWO ( 20 MARKS)**

1. Differentiate between distributed file service and distributed data store. (3 Marks)
2. Discuss three methods that are used in user authentication (3 Marks)
3. Discuss how the Berkeley algorithm works and when it is best for use. (5 Marks)
4. There are three systems on your network: A, B,C .Prior to synchronization, A’s clock reads 2:30 , B’s clock reads 2:36 , and C’s clock reads 2:42. B is the master. After synchronization via the Berkeley algorithm, what is the time on A’s clock(Ignore synchronization or network latencies. (5 Marks)
5. Why is process scheduling important? (4 Marks)

**QUESTION THREE (20 MARKS)**

1. Differentiate between load sharing and load balancing. (4 Marks)
2. Discuss the three conditions for mutual exclusion. (4 Marks)
3. Discuss the following approaches of implementing mutual exclusion Semaphores *(Dijkstra),* Monitors, Programming Languages, Hardware Locks, software Locks, Token-Passing Algorithms. (12 Marks)

**QUESTION FOUR (20 MARKS)**

1. Define the term deadlock and discuss any three conditions for a deadlock to occur(4 Marks)
2. A computer science student in Dedan Kimathi University while designing a distributed system for Nyeri county government discovered possible deadlocks, discuss four approaches he can adopt to avoid the deadlocks?
3. You are synchronizing with a server using Cristian’s algorithm. You send a message at 1;10.100 (according to your clock). The server receives the message at 1:15.000 (according to its clock), processes the request, and sends a response containing 1:15.000 (according to its clock) processes the request, and sends a response containing 1:15.005, which you receive 1:10.150. To what value do you set your clock? (6 Marks)
4. What is the meaning of a single systems image as used in distributed systems?(2 Marks)

**QUESTION FIVE (20 MARKS)**

I have just invented a new scheduling algorithm that I claim gives the highest priority to processes that have just entered the system, but is fair to all processes. The algorithm works like this: There are two queues, one for new processes and one for old processes. When a process enters the system, it is put at the end of the new queue. After two milliseconds on the new queue, whether a process has been scheduled or not, it is moved to the end of the old queue. When it is time to schedule a process, the system schedules the process at the head of one of the queues, alternating between the two queues. Each process runs to completion before the next process is scheduled. Assume that processes enter the system at random times and that most processes take much longer than 2 milliseconds to execute.

1. Does this algorithm give the highest priority to new processes? Explain your answer.

(4 Marks)

1. Is this algorithm starvation free? Explain your answer. (3 Marks)
2. Discuss whether this algorithm is fair to all processes. By ‘fair” we mean every process has a wait time approximately equal to the average wait time, assuming all processes have close to the same execution time. (3 Marks)
3. If the error of the clock at the server was$\pm 0.015$ sec and if the best case round-trip time to the server is 30 m sec.(0.030 sec), what is the time error of the synchronized clock at the client (express as $\pm E)?$ (6 Marks)