Data Provided: None

The University Of Sheffield.

DEPARTMENT OF ELECTRONIC AND ELECTRICAL ENGINEERING

Spring Semester 2015-16 (2.0 hours)

EEE6207 Advanced Computer Systems

Answer **THREE** questions. **No marks will be awarded for solutions to a fourth question.** Solutions will be considered in the order that they are presented in the answer book. Trial answers will be ignored if they are clearly crossed out. **The numbers given after each section of a question indicate the relative weighting of that section.**

1. **a.** Using a suitable diagram, describe the range of states of process, paying particular attention to the transitions between states. Explain how each of the state transitions can arise. **(5)**

In connection with the creation of child processes under the UNIX operating system, what is the copy on write mechanism? How does it work? Why is it needed? What advantages does it offer? **(5)**

b. In the UNIX operating system, describe the mechanism by which a process terminates. What is the advantage of this method? How is this mechanism modified if the process to be terminated is currently the parent to a child process? **(6)**

c. What is the major advantage claimed for the Java Virtual Machine architecture? Are there any disadvantages? **(4)**

2. **a.** Modern operating systems typically improve the performance of their file systems by caching blocks of data in memory rather than making processes wait while data is written to the physical disk; the cached blocks are typically written to the disk at some later point by kernel threads, allowing the write operation to return the calling program. Although caching improves speed of operation, it carries a major disadvantage. Explain why? **(4)**

Describe the basic processing steps involved in a redo journalling file system. How does a journalling file system overcome the disadvantage mentioned above? What is the great disadvantage of journalling? **(4)**

b. In the context of real-time operating systems, describe what is meant by the two terms:

1. Interrupting latency
2. Dispatch latency **(4)**

Explain why allowing pre-emption of the kernel can improve the performance of real-time systems. **(4)**

What do you understand by *priority inversion*? How can priority inversion be prevented? **(4)**

3. A pipelined system appears as shown in **Figure 3**.

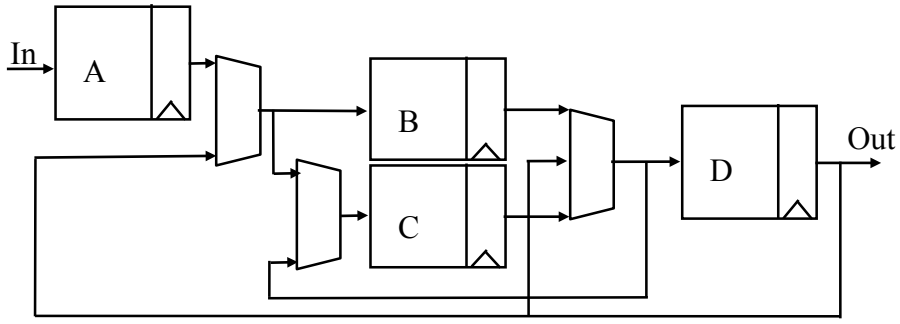

Figure 3: Pipelined System

The function of A, B and D are fixed. However, C is flexible: in particular, it can be programmed – on-the-fly – to also execute a *no-operation*, operation B, and operation E.

a. The pipeline is required to execute the following sequence of operations:

$A \rightarrow B \rightarrow C \rightarrow D \rightarrow E \rightarrow D$

i) Produce a reservation table to identify how the sequence of operations will be scheduled **(4)**

ii) Identify the throughput and latency. **(2)**

iii) Work out the utilisation of each processing block. **(2)**

iv) Write down a collision vector for this operation and draw the corresponding state transition diagram **(4)**

b. The operation is changed to:

$A \rightarrow B \rightarrow D \rightarrow B \rightarrow D \rightarrow D$

Your objective is to get as much performance out of the system as possible. How would you do this? **(8)**

4. **a.** A Delta network of size 2^3 x 2^3 is to be constructed. **(8)**

i) Draw this network, identifying its important features.

ii) Demonstrate that the network exhibits relative and absolute addressing when routing data to a particular output. **(2)**

iii) Calculate the areal efficiency (in terms of hardware) of this network – compared with a *cross-point switch* with the same number of inputs and outputs. **(2)**

b. **i)** If a network, such as the one in part **a.** is to be used to connect processors to memory then what conditions might this impose on the network? **(4)**

ii) What is a split-transaction bus and what problem does it set out to solve? **(4)**

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