CSE 542/498J Home work assignment 1

Assigned: Tues, Sep 10

Due: Tues, Sep 24, 11:00AM

Late submissions will not be accepted

Individual effort

1. In a store and forward network, a message is passed from the source node to the destination node through some number of intermediate nodes. Each node is provided with as many buffer classes as there are distances (# of hops) being covered by messages passing through. Upon arrival of an incoming message, a buffer from the class *i* is allocated for the message if it has made *i* hops so far. When the message has been successfully copied into the buffer, an acknowledgement is sent back to the last sender and a copy of the message is forwarded on toward the final destination. A node can forget about a message and release the buffer holding it when an acknowledgement is received from the next node along the path. If no acknowledgement arrives in a specified amount of time, the message is retransmitted.

Show (informally prove) that the basic idea behind this protocol can be used to avoid deadlock.

2. Consider a computer with five individual resources name R1 …. R5. Let five processes P1, …. P5 make requests in order, as follows:

    i. P1 requests R2
    ii. P4 requests R3
    iii. P3 requests R1
    iv. P2 requests R4
    v. P5 requests R5
    vi. P4 requests R2
    vii. P5 requests R3
    viii. P3 requests R5
    ix. P1 requests R1
    x. P2 requests R2

    b. Assume the resource manager uses the liberal "allocate a requested resource if it is currently free" policy. At the end of the requests, is the allocation safe or unsafe? If unsafe, is there deadlock and if so at what point did it occur and which processes did it involve?
    c. Instead of a liberal policy, imagine that processes P1 through P5 make advance claims that each needs all resources. If the Banker's algorithm is applied, how could the resources be allocated at the end of the requests?

3. Assume that the total amount of real memory is fixed. Give examples of code (or reference strings) that would exhibit each of the following behaviors:
    a. doubling the page size reduces page faults
    b. halving the page size reduces page faults Explain why in each case
    c. A group of systems designers are considering halving the page size in order to reduce the average amount of fragmentation in the last page of each address space. This is an issue of wasted space. Considering the page table space, under what conditions might this be a good idea and when might it be a bad idea?

4. Suppose we want to use a paging algorithm that requires a reference or usage bit, but the hardware does not provide one. Sketch how we could simulate a reference bit even if one were not provided by the hardware or explain why it is not possible to do so. If possible, discuss what the cost would be.

5. A certain computer provides its users with a virtual memory space of 2^{32} bytes. The computer has 2^{18} bytes of physical memory. The virtual memory is implemented by paging, and the page size is 4096 bytes. A user process generates the virtual address 11100111 in hex.

    a. What is the page number?
    b. What is the displacement within the page?
    c. How bif must a direct-mapped page table be for this computer?
    d. How big must an inverted page table be for this computer?

6. Exercise 4.6

7. Exercise 7.2

8. Exercise 7.6

9. Exercise 8.12

10. Exercise 9.10