CSCI 4100 Assignment 5

OS Textbook, Chapter 8

Use Fig. 1. below for Q1, Q2 & Q3:

Used	Hole	Used	Hole	Used	Hole	Used	Hole	Used	Hole	Used
100K	100K	200K	500K	200K	200K	300K	300K	200K	600K	100K

Fig. 1. Variable partition memory allocation

Q1 (10 points): On a system using **first-fit** allocation, assume memory is allocated as specified in Fig. 1. before additional requests for 212K, 417K, 112K, 426K (in order) are received. At what starting address will each of the additional requests be allocated? Show all intermediate working steps.

Q2 (10 points): On a system using **best-fit** allocation, assume memory is allocated as specified in Fig. 1. before additional requests for 212K, 417K, 112K, 426K (in order) are received. At what starting address will each of the additional requests be allocated? Show all intermediate working steps.

Q3 (10 points): On a system using **worst-fit** allocation, assume memory is allocated as specified in Fig. 1. before additional requests for 212K, 417K, 112K, 426K (in order) are received. At what starting address will each of the additional requests be allocated? Show all intermediate working steps.

Q4 (7.5 points): On a simple paging system with 2^{24} bytes of physical memory, 256 pages of logical address space, and a page size of 2^{10} bytes, how many bits are in a logical address? Why?

Q5 (7.5 points): On a simple paging system with 2^{24} bytes of physical memory, 256 pages of logical address space, and a page size of 2^{10} bytes, how many bytes are in a page frame? Why?

Q6 (7.5 points): On a simple paging system with 2^{24} bytes of physical memory, 256 pages of logical address space, and a page size of 2^{10} bytes, how many bits in the physical address specify the page frame (number)? Why?

Q7 (7.5 points): On a simple paging system with 2^{24} bytes of physical memory, 256 pages of logical address space, and a page size of 2^{10} bytes, how many entries are in the page table? Why?

OS Textbook, Chapter 6

Q8 (10 points): Write two short methods that implement the simple semaphore `wait()` and `signal()` operations on global variable `B`.

Q9 (10 points): Describe the dining-philosophers problem and how it relates to operating systems.

Q10 (10 points): One simple solution to the dining-philosophers problem is to represent each chopstick with a semaphore… (OS textbook, Pg 244, Figure 6.15). This solution will create a deadlock. Describe how a deadlock may happen, and suggest three possible remedies to the deadlock problem.

Q11 (10 points): Race conditions are possible in many computer systems. Consider a banking system with the following two functions: `deposit(amount)` and `withdraw(amount)`. These two functions are passed the amount that is to be deposited or withdrawn from a bank account. Assume a shared bank account exists between a husband and wife and concurrently the husband calls the `withdraw()` function and the wife calls `deposit()`. Describe how a race condition is possible and what might be done to prevent the race condition from occurring.

Submission instructions:
You can do this exercise **on paper**. Do it on paper(s), scan them and convert to one **pdf** file. (or use any method to produce one pdf file.)
Please submit an electronic copy (pdf file) to D2L digital dropbox.
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