CMPSCI 377: Operating Systems

Homework 3: Deadlocks and Memory Management

Due: November 7, 2000, in class

1. (10 pts) **Deadlock.** Short answer questions:

   (a) A system has six tape drives (a, b, c, d, e, f), with n processes competing for them. Each process may need two of the drives. For what values of n is the system deadlock free?

   (b) Can a system be in a state that is neither deadlocked nor safe? If yes, give an example system.

2. (20 pts) **Deadlock** Problem 8.9 from the textbook.

3. (10 pts) **Deadlock.** Consider the following system snapshot using the data structures in the Banker's algorithm, with resources A, B, C, and D, and processes P_0 to P_4.

	Allocation				Max				Available				Need			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
									3	2	1	0				
P_0	3	0	0	2	6	0	1	2								
P_1	1	0	0	0	1	7	5	0								
P_2	1	3	5	4	2	3	5	6								
P_3	0	6	3	2	1	6	5	2								
P_4	0	0	1	4	1	6	5	6								

   Using Banker's algorithm answer the following questions.

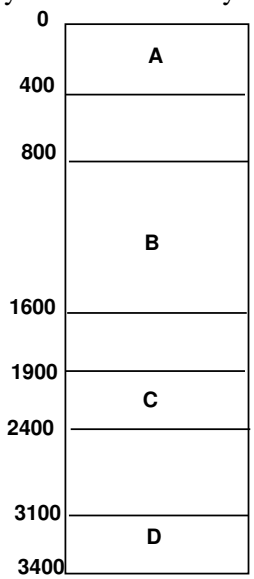
   (a) How many resources of type A, B, C, and D are there?

   (b) What is the content of the *Need* matrix?

   (c) Is the system in a safe state? Why?

   (d) If a request from process P_4 arrives for additional resources of (1,2,0,0), can the Banker's algorithm grant the request immediately? Show the new system state, and other criteria.

4. (10 pts) Consider a segmented memory system with memory allocated as shown below.



Suppose the following actions occur:

- Process E starts and requests 300 memory units.
- Process A requests 400 more memory units.
- Process B exits.
- Process F starts and requests 800 memory units.
- Process C exits.
- Process G starts and requests 900 memory units.

(a) Describe the contents of memory after each action using the first-fit algorithm.

(b) Describe the contents of memory after each action using the best-fit algorithm.

(c) How would worst fit allocate memory?

(d) For this example, which algorithm is best?