Operating systems
Final examination
(part 2)
2009/2010

Student Name:

NIA:

1. (2pt) Suppose there are 3 robots (red, blue, green), each of which is controlled by its own thread. You must ensure that the robots only move in the following order: red, blue, green, red, blue, green, etc. Write the pseudo-code that performs the appropriate initializations and enforces this execution order. Use only semaphores for your synchronization.

2. (2 pt) Is the following system of four processes with 2 resources deadlocked? Justify your answer (no justification receives 0 credit).

Current allocation matrix

P1 1 3
P2 4 1
P3 1 2
P4 2 0

Current request matrix

P1 1 2
P2 4 3
P3 1 7
P4 5 1

Availability Vector

1 4

3. (2pts) Given five memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in order), how would each of the first-fit, best-fit, and worst-fit algorithms place processes of 212 KB, 417 KB, 112 KB, and 426 KB (in order)? Which algorithm makes the most efficient use of memory?

4. (2pts) Suppose that you have a UNIX file system where the disk block size is 1kB, and an inode takes 128 bytes. Disk addresses take 32 bits, and the inode contains space for 64 bytes of data, 8 direct addresses, one indirect, one double-indirect and one triple- indirect (the rest of the space in the inode is taken up with other information such as ownership and protection). An index block is the same size as a disk block. How much space (including overhead) do files that are: a) one (1) byte long, b) 1025 bytes long, c) 65536 (64KB) bytes long, and d) 1048576 (1MB) bytes long require?
Hint: it may help if you draw a picture of how inodes are used to locate the blocks making up a file.

5. (1pt) Define external and internal fragmentation (with respect to file systems).

6. (1pt) Define the four necessary conditions for a deadlock to arise.