Birla Institute of Technology & Science, Pilani

Work Integrated Learning Programmes Division

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1. A new scheduling algorithm is invented which claims that, it gives the highest priority to processes that have just entered the system, also algorithm works fair to all processes. The algorithm implemented in following way:
   There are two queues, one for new processes and one for old processes. When a process enters the system, it is put at the end of the new queue. After 2 milliseconds on the new queue, whether a process has been scheduled or not, it is moved to the end of the old queue.

   When it is time to schedule a process, the system schedules the process at the head of one of the queues, alternating between the two queues. Each process runs to completion before the next process is scheduled. Assume that processes enter the system at random times and that most processes take much longer than 2 milliseconds to execute. And answer the following questions:

   (i) Does this algorithm give the highest priority to new processes? Explain your answer. **[4 Marks]**
   (ii) Is this algorithm starvation free? Explain your answer. **[3 Marks]**
   (iii) Discuss whether this algorithm is fair to all processes. By "fair" we mean every process has a wait time approximately equal to the average wait time, assuming all processes have close to the same execution time. **[3 Marks]**

2. Consider a process executing on an operating system that uses demand paging. The average time for a memory access in the system is M units if the corresponding memory page is available in memory, and D units if the memory access causes a page fault. It has been experimental measured that the average time taken for a memory access in the process is X units. Which one of the following is the correct expression for the page fault rate experienced by the process? **[4 Marks]**
   a) (D – M) / (X – M)
   b) (X – M) / (D – M)
   c) (D – X) / (D – M)

d) (X – M) / (D – X)

3. Assume there is an initial 1024 KB segment where memory is allocated using the Buddy System. Draw the tree illustrating how the following memory requests are allocated:

[6 Marks]

- request 200 KB,
- request 88 KB
- request 62 KB
- request 148 KB

Next, modify the tree for the following releases of memory. Perform coalescing whenever possible:

- release 62 KB
- release 88 KB
- release 148 KB
- release 200 KB

4. Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 141, and the previous request was at cylinder 124. The queue of pending requests from different processes in the order:
   85, 1470, 49, 68, 1774, 948, 1509, 1022, 1750, 112
   Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests and average seek distance for each of the following disk-scheduling algorithms? **[15 Marks]**
   (i) FCFS
   (ii) SSTF
   (iii) SCAN
   (iv) LOOK
5. Consider a user program of logical address of size 6 pages and page size is 4 bytes. The physical address contains 300 frames. The user program consists of 22 instructions a, b, c, . . . u, v . Each instruction takes 1 byte. Assume at that time the free frames are 7, 26, 52, 20, 55, 6, 18, 21, 70, and 90. Find the following? **[2*5 =10 Marks]**
   (i) Draw the logical and physical maps and page tables?
   (ii) Allocate each page in the corresponding frame?
   (iii) Find the physical addresses for the instructions m, d, v, r?
   (iv) Calculate the external fragmentation if exist?
   (v) Calculate the internal fragmentation if exist?

6. Is it possible to have a deadlock involving only a single process? Explain your answer.

[3 Marks]

7. A system uses FIFO policy for page replacement. It has 4 page frames with no pages loaded to begin with. The system first accesses 100 distinct pages in some order and then accesses the same 100 pages but now in the reverse order. How many page faults will occur?

[2 Marks]

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