Assignment 6 – Memory Management (8%)

Introduction

Assignment 6 contributes 8% towards your final course grade and the assignment total is 23 marks. You should begin Assignment 6 after completing the materials in Module 9; it is due at the end of Module 10. Check your Course Schedule for the precise due date. Directions for submitting Assignment 6 to your Open Learning Faculty Member for grading can be found in the Assignments Overview tab. An assignment marking criteria and your assignment submission details follows at the end of this document.

In this assignment, you will investigate how main memory is allocated and how paging works.

Questions:

1. The following indicates a part of memory, available for allocation. The memory is divided into segments of fixed sizes of the following sizes.

   10 KB 4 KB 20 KB 18 KB 7 KB 9 KB 12 KB 15KB

   Three processes A, B, and C with the respective sizes of 12 KB, 10 KB and 9 KB are to be allocated successively.

   Draw the results of the allocation when the following allocation methods are used:

   a. first fit
   b. best fit
   c. worst fit
   d. next fit

   Which algorithm makes use of the memory space the best?

2. A computer with 16 bit address has virtual address space of 64 KB and physical memory of 32 KB. The size of a page is 4 KB.
   a. How many virtual pages and page frames are generated?
   b. Determine the size of a page table for a computer with 32 bit address, a page size of 4 KB and each entry in the page table requires 4 bytes.

3. Suppose that we have free segments with sizes: 6, 17, 25, 14, and 19. Place a program with size 13kB in the free segment using first-fit, best-fit and worst fit? Indicate which segment it will be in for each of the 3 algorithms.
4. Consider a logical address space of 8 pages of 1024 words each, mapped onto a physical memory of 32 frames.

   How many bits are there in the logical address?
   How many bits are there in physical address?
5. Suppose the page table for a process currently executing on the processor looks like the following. All addresses are memory byte addresses, and addresses in the main memory and processes start from zero. The page size is 512 bytes.

Virtual page number	Valid bit	Page frame number
0	1	4
1	1	7
2	0	1
3	1	2
4	0	8
5	1	0

   What physical address, if any, would each of the following virtual addresses correspond to? Be sure to indicate if the corresponding address is a valid physical address.

   (i) 152

   (ii) 1121

   (iii)2499

6. Consider the following segment table:

Segment	Base	Limit
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

All addresses are memory byte addresses, and addresses in the main memory and processes start from zero. What are the physical addresses for the following logical addresses (segment number, offset)?

(a) 0, 430
(b) 1, 10
(c) 2, 500
(d) 3, 400
(e) 4, 112

7. Consider the following page-reference string in virtual memory management: 1, 2, 8, 3, 4, 2, 1, 5, 6, 2, 1, 3, 7, 6, 3. Assuming four frames, how many page faults would occur for the following replacement algorithms? Remember that all frames are initially empty, so all of your first unique pages will cost one fault each.
   (a) LRU replacement
   (b) FIFO replacement
   (c) Optimal replacement

Report Submission Details

You need to submit a report that consists of answers to the listed questions.

Assignment Marking Criteria	Weighting
Q 1	/5
Q 2	/2
Q 3	/3
Q 4	/2
Q 5	/3
Q 6	/5
Q 7	/3
Total	/23