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**COMP 3410 - Operating Systems (3, 1, 0)**

**Lab/assignment 6: Memory Management**

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.

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

1. first fit –

|  |
| --- |
| **10 – B = 0** |
| **4** |
| **20 – A = 8** |
| **18 – C = 9** |
| **7** |
| **9** |
| **12** |
| **15** |

* + A fits in 20
  + B fits in 10
  + C fits in 18
  + New Memory Blocks: **0** 4 **8** **9** 7 9 12 15

|  |
| --- |
| **10 - B = 0** |
| **4** |
| **20** |
| **18** |
| **7** |
| **9 – C = 0** |
| **12 – A = 0** |
| **15** |

1. best fit
   * A fits in 12
   * B fits in 10
   * C fits in 9
   * New Memory Blocks: **0** 4 20 18 7 **0** **0** 15

|  |
| --- |
| **10** |
| **4** |
| **20 - A = 8** |
| **18 - B = 8** |
| **7** |
| **9** |
| **12** |
| **15 – C = 6** |

1. worst fit
   * A fits in 20
   * B fits in 18
   * C fits in 15
   * New Memory Blocks: 10 4 **8** **8** 7 9 12 **6**

|  |
| --- |
| **10** |
| **4** |
| **20 - A = 8** |
| **18 - B = 8** |
| **7** |
| **9 – C = 0** |
| **12** |
| **15** |

1. next fit
   * A fits in 20
   * B fits in 18
   * C fits in 9
   * New Memory Blocks: 10 4 **8** **8** 7 **0** 12 15

Which algorithm makes use of the memory space the best?

**Best fit makes best use of the memory allocation leaving back the least amount of left over memory blocks after being allocated.**

1. 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.
   1. How many virtual pages and page frames are generated?

**Number of pages = 64/4 = 16**

**Number of frames = 32/4 = 8**

**Logical address space = 2^16 = 65536 bytes ~ 64KB**

* 1. 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.

**Logical address space = 2^32 = 4294967296 = 4 GB**

**Number of pages or page entries = (4GB / 4KB) = 1048576 entries**

**Page table size = 1048576\*4 = 4194304 bytes = 4MB**

1. Programming assignment:

Assume that a system has a 32 bit virtual address with 4 – kb page size. Write a C program that is passed a virtual address in decimal on the command line and have it output the page number and offset for the given address.

#include <stdio.h>

#include <stdlib.h>

#include <string.h>

#include <math.h>

int main(int size, char \*data[]){

//check if no address was provided when running

if(size<2){

printf("Please enter atleast 2 two arguments to run");

return -1;

}

long virtualAddress = atol(data[1]);

// Check if address is valid

if(virtualAddress>pow(2,32)||virtualAddress<0){

printf("Address out of memory\n");

return -2;

}

long pageSize = 4096;

long pageNumber = virtualAddress/pageSize;

double offset = virtualAddress%pageSize;

printf("Page Number=>%d \nOffset=>%.f\n", pageNumber,offset);

return 0;

}

