Assignment 6:

Memory Management

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COMP 3411 – Operating System

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October 12, 2021

# Question 1

1. First fit
2. Best fit
3. Worst fit
4. Next fit  
     
   I would say that the Best Fit algorithm makes the best use of memory space in this case as the process A, B, and C all fit nicely into the segments 7, 1, and 6 respectively without the need of memory compact.

# Question 2

1. Each page is 4kB in size, that is 212 bytes  
   Since the virtual address space size is 64kB, that is 216 bytes. Thus, 216 / 212 = 24 = 32 virtual pages can be generated  
   Since the physical address space size is 32kB, that is 215 bytes. Thus, 215 / 212 = 23 = 8 physical page frames can be generated
2. A 32-bit computer can address 232 bytes  
   Since each page is 4kB, or 212 bytes, a page table can consist of 232 / 212 = 220 pages  
   Since each entry in a table is 4 bytes, the total size of a page table can be 220 \* 4 = 222 bytes = 4 MB

# Question 3

With free the segments with sizes: 6, 17, 25, 14, and 19 kB; placing a program with size 13kB in the segments using the following algorithms:

First fit: the program will be placed into the 2nd (17kB) segment leaving it with the remaining 4kB unallocated memory

Best fit: the program will be placed into the 4th (14kB) segment leaving it with the remaining 1kB unallocated memory

Worst fit: the program will be placed into the 3rd (25kB) segment leaving it with the remaining 12kB unallocated memory

# Question 4

Since each page is 1024 words each, they each would require 210 bits.

Since there are 8 pages in the logical address space, that is 23 pages. Thus, the logical address would require 10 + 3 = 13 bits

Since there are 32 frames in the physical memory space, that is 25 frames or pages. Thus, the physical address would require 10 + 5 = 15 bits

# Question 5

Since each page is 512 bytes

1. 152 = 512 + (-360)  
   Thus, the virtual page number is 0, which correspond to page frame number 4, which is valid, and the offset is 360
2. 1121 = 512 \* 2 + 97  
   Thus, the virtual page number is 2, which correspond to page frame number 1, which is invalid, and the offset is 97
3. 2499 = 512 \* 4 + 451  
   Thus, the virtual page number is 4, which correspond to virtual page number 8, which is invalid, and the offset is 451

# Question 6

1. (0, 430). Physical address = base + offset = 219 + 430 = 649
2. (1, 10). Physical address = base + offset = 2300 + 10 = 2310
3. (2, 500). Illegal address since the offset 500 is larger than the limit = 100 of segment 2
4. (3, 400). Physical address = base + offset = 1327 + 400 = 1727
5. (4, 112). Illegal address since the offset 112 is larger than the limit = 96 of segment 4

# Question 7

1. There will be 11 page faults using the LRU replacement algorithm  
   A picture containing text

   Description automatically generated
2. There will be 11 page faults using the FIFO replacement algorithm  
   Text

   Description automatically generated with low confidence
3. There will be 9 page faults using the Optimal replacement algorithm  
   Diagram, schematic

   Description automatically generated