Operating Systems-2
CS 3523 Spring 2019
Theory Assignment

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Solution: Q1

Given: Page size: 2KB = 2^{11} , Address: 4095_{10} = $(0000111111111111)_2$
Therefore, the page number is floor(4095 /2^{11}) = 1 [Assuming zero-based indexing]
Therefore, Page offset: $(11111111111)_2$

Solution: Q2

Given: Page size = 2KB = 2^{11}, Physical Address size = 2^{24}
Therefore, no of frames = $2^{24}/2^{11}$ = 2^{13}
Number of entries in inverted page table = No. of frames = 2^{13}

Solution: Q3

Given: Size of Available Chunk: 512KB, Size of Memory Request: 57KB

Divide 512KB chunk into two parts of 256KB each.
Divide one 256KB chunk into two parts of 128 KB each.
Finally, Divide one 128KB into two parts of 64KB each.
We allocate 64KB memory to kernel because any further division will reduce the size of memory block than the required memory block i.e. 57KB.

Solution: Q4

a) Given: Page segment = 0 and offset = 345.
As 345 < 420, It is a valid physical address
Therefore, Physical address= 239 + 345 = 584
b) Given: Page segment = 3 and offset = 666.
Invalid because 666 > 555
c) Given: Page segment = 2 and offset = 876.
As 876 < 1400, It is a valid physical address
Therefore, Physical address= 5450 + 876 = 6326

Solution: Q5

Segment	Base	Length
0	1100	700
1	9350	550
2	5600	600
3	2200	3400
4	6200	2500

Solution: Q6

- To store the length of each page
- To check if the logical address is valid.

Solution: Q7

Outer most page table has 536870912 entries = 2^{29}. Therefore, 29 bits.
Second-level page table has 8192 entries = 2^{13}. Therefore, 13 bits
Third level page table has 512 entries = 2^{9}. Therefore, 9 bits
Fourth level page table has 64 entries = 2^{6}. Therefore, 6 bits

So a total of 57 bits are required for determining page configurations.
So, rest 7 bits are reserved for offset.

Outermost	Second level	Third Level	Fourth	Offset
29	13	9	6	7

Solution: Q8

Best Fit algorithm:

Process No.	Process Size	Memory Partition Size
1	135 KB	155 KB
2	650 KB	890 KB
3	398 KB	480 KB
4	220 KB	220 KB
5	520 KB	580 KB
6	440 KB	600 KB

Worst-Fit algorithm:

Process No.	Process Size	Memory Partition Size
1	135 KB	890 □ 755 KB left in 5th memory partitions
2	650 KB	755 □ 105 KB left in 5th memory partitions
3	398 KB	600 □ 202 left in 6th memory partitions
4	220 KB	580 □ 360 left in 2nd memory partitions
5	520 KB	Not possible to allocate memory
6	440 KB	480 □ 40 left in 3rd memory partitions

Solution Q9

VALID	VALID	INVALID	VALID	INVALID
VALID	INVALID	VALID	VALID	INVALID
FREE	VALID	VALID	VALID	INVALID

Erase Operation No.	**After Write Operation No.**	**Write Operation**
1	15	0
2	17	8
3	19	3
4	22	7

Therefore, total no. of erase operations = 4

Solution Q10

Given: Total Size: 64GB, Block Size: 4KB,
(No. of physical pages) = 4 * (No. of logical pages)

No. of logical pages = 64GB / 4KB = 2^{24}
Therefore, no. of physical pages = 4 * 2^{24} = 2^{26}
So, Table Size = (no. of pages) * log(no. of physical pages)
= 2^{24} * log(2^{26}) = 26 * 2^{24} Bits = 52 MB