P.S. Assignment - 5

Q1) Given four memory locations of 200k, 600k, 400k, 700k (in order). How the first-fit, Best-fit, Worst-fit algorithms place processes of 312k, 517k, 212k, 526k (in order). Which algorithm makes the most efficient use of memory?

(Ans) Memory partition → 200k, 600k, 400k, 700k

Processes → 312k, 517k, 212k, 526k

First fit

312k in 600k
517k in 700k
212k must wait
526k must wait

Best Fit

312k in 400k
517k in 600k
212k in 700k
526k must wait

Worst Fit

312k in 700k
517k in 600k
212k in 400k
526k must wait.

Q2) Using Page size of 16 bytes a physical memory of 2048 byte and logical memory of 128 bytes.

a) Find the number of bits required to represent logical address
b) Find the number of bits required to represent logical address
c) Find the number of entries in the page table.

d) Find the total no. of frames

e) Find the physical address of the logical address 80 with the following page table :

8
6
5
2
3
1
4
7

(Ans) a) No. of bits required to represent logical address

2^n = 128 bytes

$\Rightarrow n = 17$

b) No. of bits required to represent physical address

2^n = 2048 bytes

$\Rightarrow n = 21$

c) No. of entries in page table

$2^{17} / 16$ bytes

$\Rightarrow 2^{17} / 2^{14} = 2^3$

d) Total no. of frames = $2^{21} / 2^{14} = 2^7$

e)

0	8
1	6
2	5
3	2
4	3
5	1
6	4
7	7

20/16 = 1

20 % 16 = 4

6 x 16 + 4 = 100

Q3) How many numbers of pages are required for a process having size 3005 bytes with a page size of 200 bytes?

(Ans) No. of pages = $\frac{\text{Process size}}{\text{Page size}}$

$= \frac{3005}{200} = 40$ page + 5 bytes

Q4) With a page size of 2048 bytes, find the amount internal fragmentation occurs for storing a process of size 72766 bytes.

(Ans) No. of page = 35 page + 1086 bytes

Internal fragmentation = 2048 - 1086 = 962 bytes.

Q5) Consider a machine with 64mb physical memory and a 32-bit virtual address space. If the page size is 4KB, how many entries will there be in a conventional single level page table and in an inverted page table?

(Ans) No. of pages = $2^{32}/2^{12} = 2^{20}$

No. of entries = 101 conventional single-level

2^{26} = Total physical memory

2^{12} page size = frame size

$2^{29}/2^{12} = 2^{17}$ = Total no. of frame

Number of entries = 128k inverted page table

Q6) In paging scheme, if the page size is 2KB and process size is 83412 bytes. Then find the number of pages required and the size of internal fragmentation.

(Ans) No. of page = $\frac{83412 \text{ bytes}}{2000 \text{ bytes}}$ = 41 page + 1412 bytes

Internal fragmentation = 2000 - 1412 = 588 bytes.

07) A specific editor has 200K of program text, 15K of initial stack, 50K of initialized data, and 70K of bookkeeping code. If five processes are started simultaneously, how much physical memory is needed if shared program text is used?

(Ans) Total physical memory needed = 200 + 15 + 50 + 70 = 335K

08) If the hit ratio of a translational look A-side Buffer (TLB) is 80% & it takes 15 nanoseconds to search the TLB and 150 nanoseconds to access the main memory, what is the effective access time?

(Ans) $\alpha = 80\%$, $\varepsilon = 15$ nS

150 ns for memory access

$EAT = 0.80\,(15+150) + 0.20\,(15+100+100) = 175$ nS

09) A computer system implements 8KB pages and a 32-bit physical address space. Each page table entry contains a valid bit, a dirty bit, three permissions bits, and the frame numbers. If the maximum size of the page table of a process is 24 kilobytes. Find the length of the virtual address supported by the system in bits.

(Ans) Page size $= 2^{13}$ bytes = framesize

No. of frame $= 2^{32} / 2^{13} = 2^{19}$

All entries can be addressed by 23 bits

$8 \times 2^{20} = 2^{23}$

Virtual address = 23 + 13 = 36 bits.

010) Consider the byte addressable system with physical address space of 128 byte, logical address space of 64 bytes & a page size of 8 byte. The page-table is specified as follows.

4
5
1
3

a) Find the number of bits required to represent logical address.

b) Find the number of bits required to represent the physical address.

c) Find the physical address of the logical address 12

d) Find the physical address in hexadecimal representation of the logical address (35)x

(Ans) a) No. of bits required to represent logical address

$2^n = 64$ bytes

$\Rightarrow n = 16$

b) $2^n = 128$ bytes

$\Rightarrow n = 17$

c)

0	4
1	5
2	1
3	3

$12/16 = 0$

$12 \% 16 = 12$

$\therefore 16 \times 12 + 12 = 204$

d) $35 \rightarrow 0011 \quad 0101$

Page size $16 kk = 2^{14}$. So #4 bits are offset.

$0100 \quad 0000 \quad 0011 \quad 0101 \rightarrow 4035$

Q11) consider the following segment table

segment	Base	Length
0	219	600
1	2300	100
2	-90	110
3	1327	400
4	1950	50

what are the physical addresses for the following logical address ? (6)

a) 0, 430

b) 1, 10

c) 2, 100

d) 2, 500

(Ans) a) 0, 430

219 + 430 = 649

b) 1, 10

2300 + 10 = 2310

c) 2, 100

90 + 100 = 190

d) 2, 500

Illegal reference