CS 342 - Homework 2

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① 1000: 2 times
2000: 3 times
5000: 2 times
1100: 2 times
300: 2 times
6000: 1 time
6100: 2 times

② i) Turnaround times

P1: N + N-1 + N-2 + ... 2 + 1

P2: N + N-1 + ... 2 + 1

...

PN: N

AvgWT = Sigma(i²) - Sigma(i) / N

where 1 <= i <= N

= (N-1)(N+1)/3

ii) AvgWT = (1/N) Sigma((i-1)i/2) = (1/N) Sigma((i² - i)/2)

= (N-1)(N+1)/6

iii) AvgWT = (1/N) [Sigma(i²) - Sigma(i)]

= (N-1)(N+1)/3

(3) a) Page Size: 2^{10} = 1 KB

b) Each third level can map $2^8 \cdot 2^{10}$ = 256 KB of virtual memory

Each second level can map $2^8 \cdot 2^8 \cdot 2^{10}$ = 64 MB of virtual memory.

we need total 7 second level tables,

we need total 1360 third level tables.

(4) Linear addresses:

0,50: 1024+50 = 1074

1,0: 4196+0 = 4196

1,100: 4196+100 = 4296

1,700: 4196+700 = 4896

2,10: 128+10 = 138

3,200: 2048+200 = 2248

→ Convert to physical corresponding address.

1074: is on page #16, frame 26

then phy. add. 26.64+50 = 1714

4196: is on page #65, frame 75

then phy. add. 75.64+36 = 4836

4296: is on page #67, frame 77

then phy. add. 77.64+8 = 4936

4896: is on page #76, frame 86

then phy. add. 86.64+32 = 55316

138: is on page #2, frame 12

then phy. add 12.64+10 = 778

2248: is on page #35 frame 45

then phy. add 45.64+8 = 2888

5) $500ns = (1-p)\,200ns + p\,10000000ns$ then $p \approx \frac{300}{10000000} = 3 \cdot 10^{-5}$

7) a) Page table will have $2^{36} / 16KB = 2^{22}$ entries

Page table size = $2^{22} \cdot 8 = 32MB$

2 page table space is needed for them -1 $2 \cdot 32MB = 64MB$ //

b) Second level table can map: $2^{11} \cdot 2^{14} = 32MB$ of V.M to Physical Memory.

Process 1 requires $\underline{6}$ second level page tables.

Process 2 requires $\underline{8}$ second level page tables.

Total: All second level page table is required.

c) Inverted page table needs RAM-size / framesize many entries.

$4GB / 16KB = 2^{20}$ entries. Then, each entry is 8 bytes.

$2^{20} \cdot 8 = 8MB$ required.

(Question 6 is on the next page)

(6)

a) $2^9 / 2^3 = 2^6$ entries to index block.

To handle 64 data block pointer → $64 \cdot 512 = 32$ KB

1 single → $2^6 \cdot 2^9 = 32$ KB

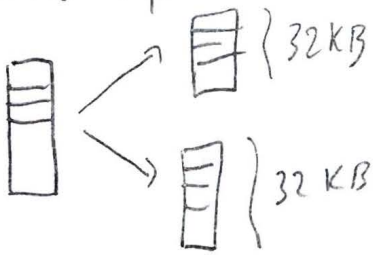
1 double indirect → $2^6 \cdot 2^6 \cdot 2^9 = 2^{21} = 2$ MB

1 triple indirect → $(2^6)^3 \cdot 2^9 = 2^{27} = 128$ MB

Total = $32 + 32 = 64$ MB

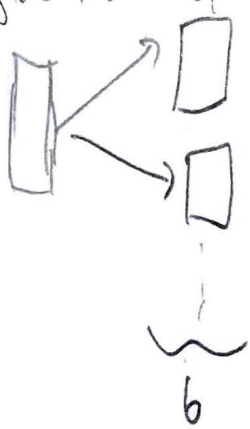
$2 + 128 = 130$ MB

b) (1) 64 KB requires 1 double indirect pointer



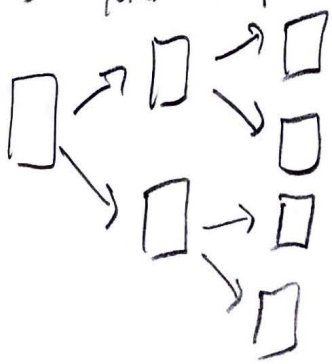
3 index blocks

(2) 192 KB requires 1 double indirect



7 index blocks

(3) 4 MB requires 1 triple indirect



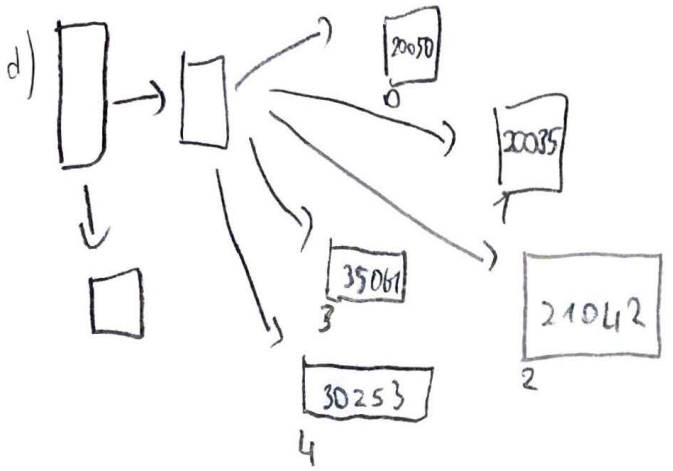
→ $(2^6)^2 \cdot 2^9 = 2$ MB

$3 + 2^7$ index blocks

c) A: $(3+2^7)$ 10 ms

B: $(7+7.2^6)$ 10ms

C: $(3+2^7+2.2^6.2^6)$ 10ms

d) 

$\frac{1700}{512.512} \rightarrow Q=0, R=1700$

$\frac{1700}{512} = 3$

$1700 \% 512 = 264$

1700 located in 35041 disk block

displacement: 264

e) $\frac{128.2^{30}}{512} = 2^{28}$ disk blocks

$\frac{2^{28}}{2^3} = 2^{25}$ bytes → 32 MB