18K-0363
Wajahat

OPERATING SYSTEMS

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K18 0363
Section: 2C

Q1.

i. - A thread blocking system Calls blocks the entire process
- Multiple threads Cannot run in parallel as only one thread can access the Kernal at a time
- Coordinated termination
- Signal & error handling

ii. Monolethic Kernel
- Entire OS is placed inside the Kernel
- Runs as single large process
- have single address space
- Bigger in Size
- Easy to implement

Micro Kernel
- Bare minimum is placed inside OS
- Kernel is broken down into processes Called Servers
- Have different address spaces
- Smaller in size
- Tough to implement.

REB3/2.

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Ujjateb

iii. By implementing priority-inheritance protocol. In this, processes accessing ~~higher priority until they are finished with resorces~~ resorces needed by a higher priority process inherit higher priority until they are finished with resorces in question. After that their priority returns to orignal values.

iv. User level threads are managed by run-time system. Kernel is not aware of its existance.

Pros: - Can be implemented on OS that does not support threads
- Simple representation
- Simple management
- Fast & Efficient

Cons: - If a thread blocks, Kernel may block all threads
- Not suitable for multiprocessor system
- Donot support system wide Scheduling priority.

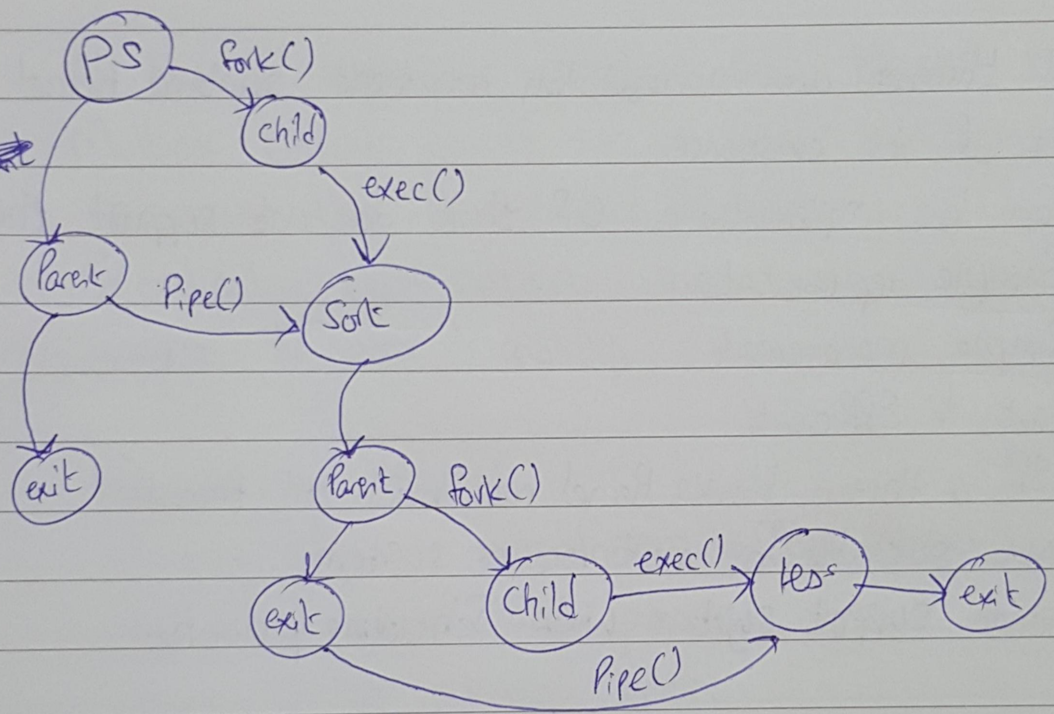
Kernel level threads are managed by Kernel. OS supports it.

Pros: - Each thread can be treated seperately
- A thread block does not mean blocking of all threads
- Routing itself as multithreaded.

Cons: - Slower
- Overheads & increased Kernel Complexity.

v. Data parallelism is Simultaneous execution on multiple cores of same function accross the elements of data set. Task parallelism is simultaneous execution of multiple cores of many different functions accross same or different datasets.

Q2. PS | Sort | Less



PS will create a child process & call exec to make it sort passing the data via pipe.

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Q3. Semaphore Cross = 1

```
while (true)
{   wait (cross) {
        while (cross <= 0) ;
        S--
    }
    // crossing bridge
    Signal (cross) {
        S++
    }
    // crossed bridge
}.
```

Q4.

i)

P1	P2	P3	P4	P2	P5	P1

0   1   2   7   14   17   20   28

Turn around Time = Completion − Arrival

$P_1 = 28 - 0 = 28$

$P_2 = 17 - 1 = 16$

$P_3 = 7 - 2 = 5$

$P_4 = 14 - 3 = 11$

$P_5 = 20 - 4 = 16$

Avg TAT = 28+16+5+11+16 /5

= 15.2

Avg Wait =

$P_1 = 28 - 9$

$P_2 = 16 - 4$

$P_3 = 5 - 5$

$P_4 = 11 - 7$

$P_5 = 16 - 3$

Avg Waiting = 9.6.

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ii) Round Robin

P1	P2	P3	P4	P5	P1	P2	P3	P4	P1	P4

0 3 8 9 12 15 18 19 21 24 27 28

Avg. TAT = (27-0) + (19-1) + (21-2) + (28-3) + (15-4) / 5 = 20
Avg. Waiting = (27-8) + (18-4) + ~~[illegible]~~ + (19-5) + (25-7) + (11-3) / 5 = 14.4.

iii) Shortest Remaining Time First

P1	P2	P5	P2	P3	P4	P1

0 1 4 7 8 13 20 28

Avg. TAT = ((28-0) + (8-1) + (13-2) + (20-3) + (7-4)) / 5 = 13.2
Avg. WAT = ((28-9) + (7-4) + (11-3) + (17-7) + (3-3)) / 5 = 7.6

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Q5.

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6

a) LRU

f_3			3	3	3	1	1	1	2	2	2	2	2	6	6	6	1	1	1	6
f_2		2	2	2	2	2	2	6	6	6	6	3	3	3	3	3	3	3	3	3
f_1	1	1	1	4	4	4	5	5	5	1	1	1	7	7	7	2	2	2	2	2
	*	*	*	*	Hit	*	*	*	*	*	Hit	*	*	*	Hit	*	*	Hit	Hit	*

Hits = 5

Faults = 15

b) Optimal

		3	4	4	4	5	6	6	6	6	6	6	6	6	6	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	7	7	7	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	6
*	*	*	*	H	H	*	*	H	H	H	*	*	H	H	*	*	H	H	*

Hits - 9 Faults = 11

c) Second Chance.

		3	3	3	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3
	2	2	2	2	2	2	6	6	6	6	3	3	6	6	6	1	1	1	6
1	1	1	4	4	4	5	5	5	1	1	1	7	7	7	2	2	2	2	2
				H						H							H	H	

Hits = 4 Faults = 16.

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Q6. Assuming 4KB (4096) page size

a) 3085/4096 ⇒ Page # = 0 offset = 3085

b) 42095/4096 ⇒ Page# = 10 offset = 1135

c) 215201/4096 ⇒ Page # = 52 offset = 2209

d) 650,000/4096 ⇒ Page # = 158 offset = 2832

e) 2000,001/4096 ⇒ Page # = 488 offset = 1153

Q7.

Page Table:

Finding entries in page

$4KB = 2^2 \cdot 2^{10} = 2^{12}$

32 − page bits

32 − 12 = 20

20 entries

Inverted Page Table

physical memory: $2^9 \times 2^{20} = 2^{29}$

$\frac{2^{29}}{2^{12}} = 2^{17}$ entries in inverted page table.

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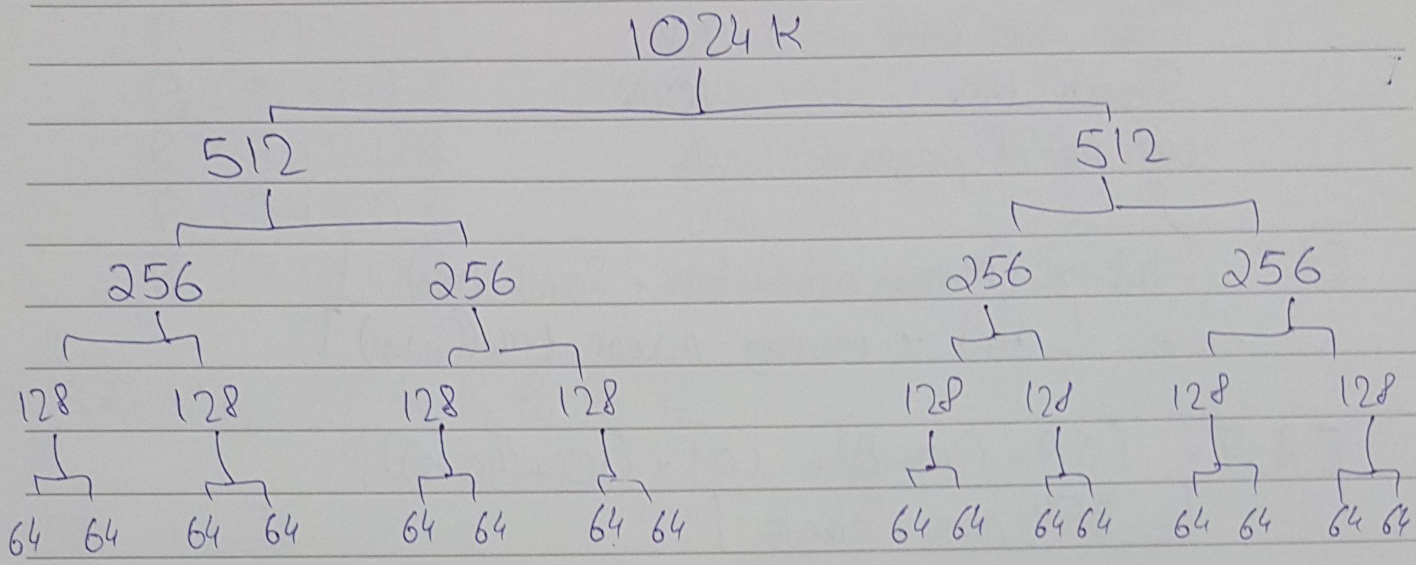
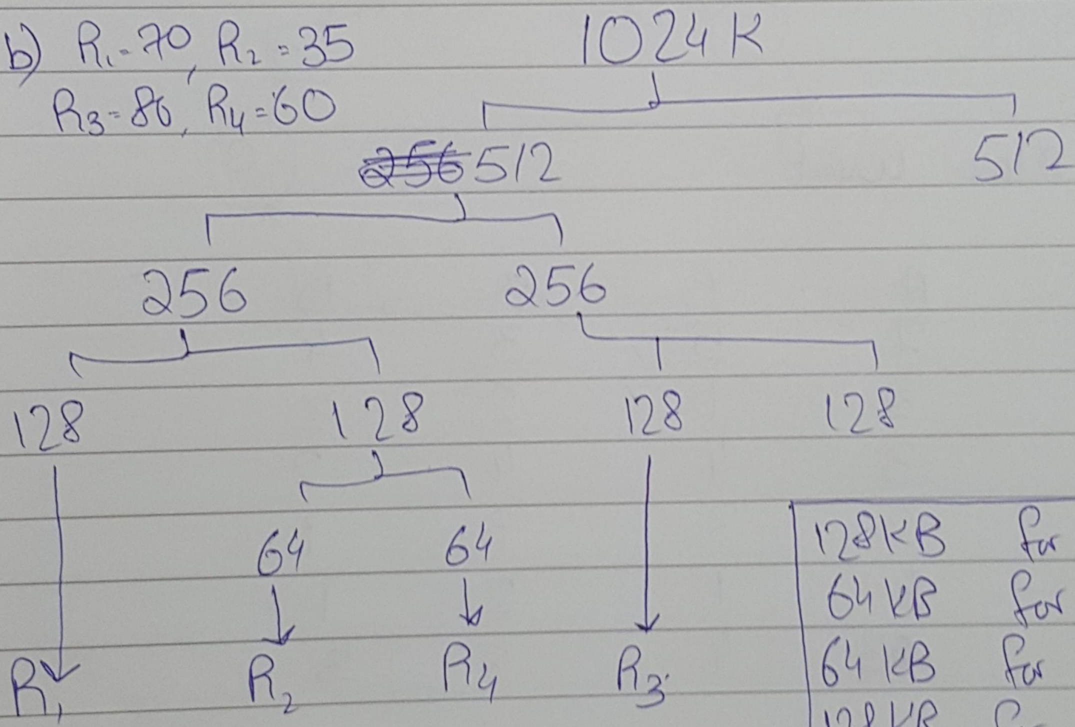
Q8. a) 1 MB block = 1024 KB



b) $R_1 = 70$, $R_2 = 35$
$R_3 = 80$, $R_4 = 60$



128 KB	for	R_1
64 KB	for	R_2
64 KB	for	R_4
128 KB	for	R_3.

REB3/2.

Q9.

Memory Access Time : 40ns
TLB hit ratio = 90%
Search time = 10ns
Level no. of pages = 1

EAT = [hit × (Memory access time + Search time)]
+ [fail × memory access time (failed)].

$E.A.T = (0.9 \times (40+10)) + (0.1 \times (10 + (40 \times 2)))$

$\boxed{= 54 \text{ nano Seconds}}$

Q10.

a) Need = Max - Current

Process	A	B	C	D
P_0	7	5	3	4
P_1	2	1	2	2
P_2	3	4	4	2
P_3	2	3	3	1
P_4	4	1	2	1
P_5	3	4	3	3

b) available => (6, 3, 5, 4)

P_1 (2,1,2,2) < . available = (6,4,6,5)

P_2 (3,4,4,2) < available = (10,5,6,7)

P_3 (2,3,3,1) < available = (11,5,6,8)

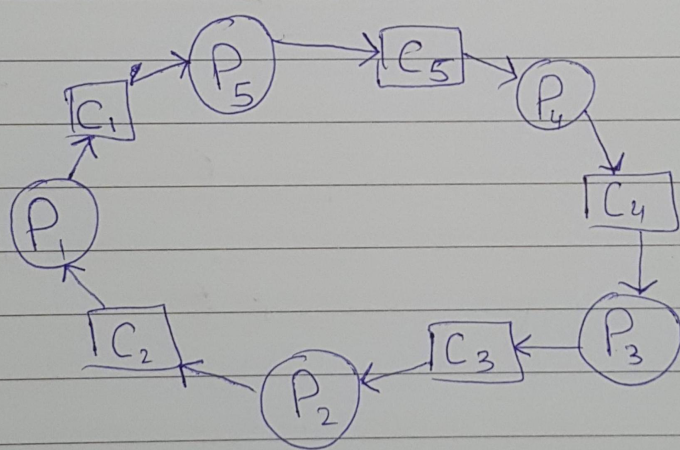
P_4 (4,1,2,1) < available = (12,6,6,8)

P_5 (3,4,3,3) < available = (13,6,7,9)

P_0 (7,5,3,4) < available = (15,6,9,10)

Safe Seq = $P_1, P_2, P_3, P_4, P_5, P_0$.

Q11.



P = Philosphers
C = chopsticks