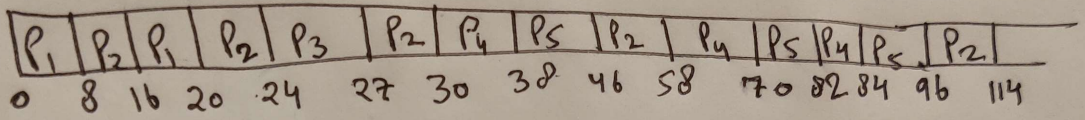
Process	AT	BT
P_1	0	12 ~~10~~
P_2	5	~~45 37 33 30~~ 18
P_3	24	3 ~~0~~
P_4	30	~~22 14 7~~ 0
P_5	33	~~32 24 16~~ 0

Q_1 TQ 8 — P_1 P_2 P_3 P_4 P_5

Q_2 TQ 12 — P_1 P_2 P_3 P_2 P_4 P_5

Q_3 SJF — P_2 P_4 P_5



	CT	TAT	WT
P_1	20	20	8
P_2	114	109	64
P_3	27	3	0
P_4	84	54	32
P_5	96	63	31
		249	~~135~~

P_2 = interrupted 4 times

P_2 will terminat at Q_3.

Avg TAT = 49.8

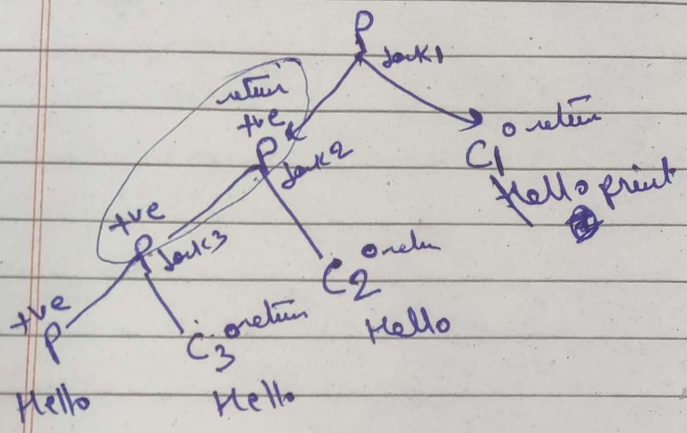
Avg WT = 27

Date:
Page No:

T1 Solution

Q5 (a)

```
if ( fork1() && fork2() )
    fork3();
Printf ("Hello");
```



1. Parent & child has same code now.
2. for child C1 first value is 0, && operator is used so $fork_2()$ will not be executed. nor $fork_3()$.
3. for parent first value in if is +ve, so $fork_2()$ will get executed.
4. Now, parent P has both +ve value in if, so, again $fork_3()$ executed.

O/P Hello Hello Hello Hello

12
1X
2

Jaypee Institute of Information Technology, Noida
T1 Examination 2022
Semester – 5th
Operating System and Systems Programming
15B11CI412
T1 SOLUTION

1. **[1 MARK EACH]**

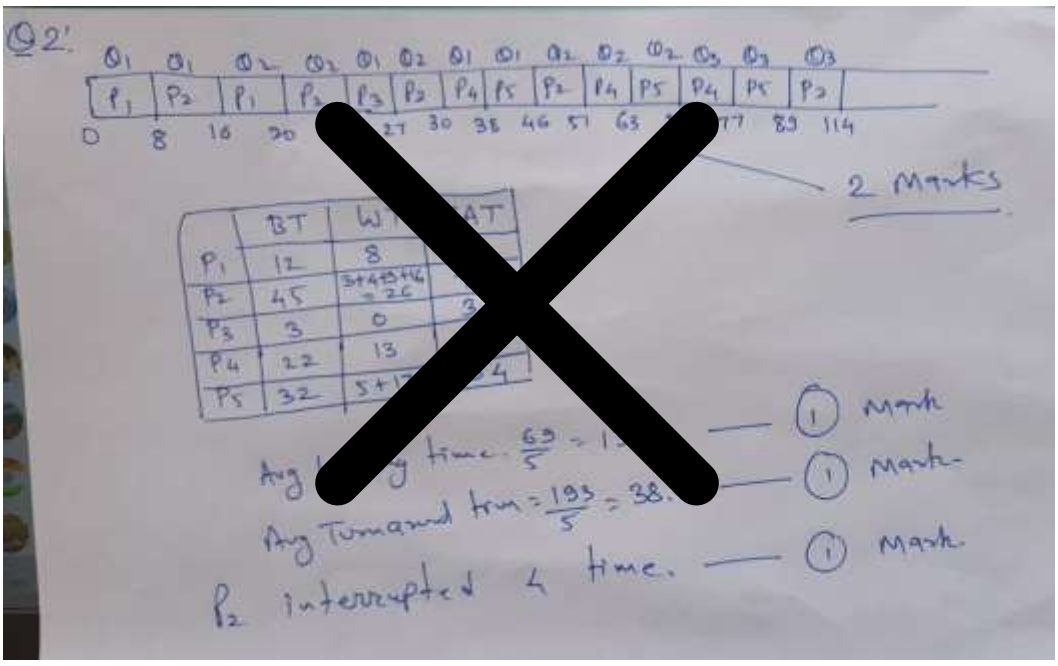
a) A system call differs from a user function in several key ways.

- A system call has more privilege than a normal subroutine. A system call runs with kernel-mode privilege in the kernel protection domain.
- System call code and data are located in global kernel memory.
- System calls cannot use shared libraries or any symbols not found in the kernel protection domain.

b) A microkernel is a kernel type that implements an operating system by providing methods, including low-level address space management, IPC, and thread management. On the other hand, a monolithic kernel is a type of kernel in which the complete OS runs in the kernel space.

c) Parallel Computing**:**
In parallel computing multiple processors performs multiple tasks assigned to them simultaneously. Memory in parallel systems can either be shared or distributed. Parallel computing provides concurrency and saves time and money.
Distributed Computing**:**
In distributed computing we have multiple autonomous computers which seems to the user as single system. In distributed systems there is no shared memory and computers communicate with each other through message passing. In distributed computing a single task is divided among different computers.

2. [2 MARKS + 2 MARKS + 1 MARK]



P2 is interrupted 4 times and ends in Q3.

3. [1.5 MARKS+1 MARK+1.5 MARKS]

a) The number of kernel threads allocated to the program is less than the number of processors.

The scheduler can only schedule user level processes to the kernel threads, and since some of the processes are not mapped to the kernel threads, they will be idle.

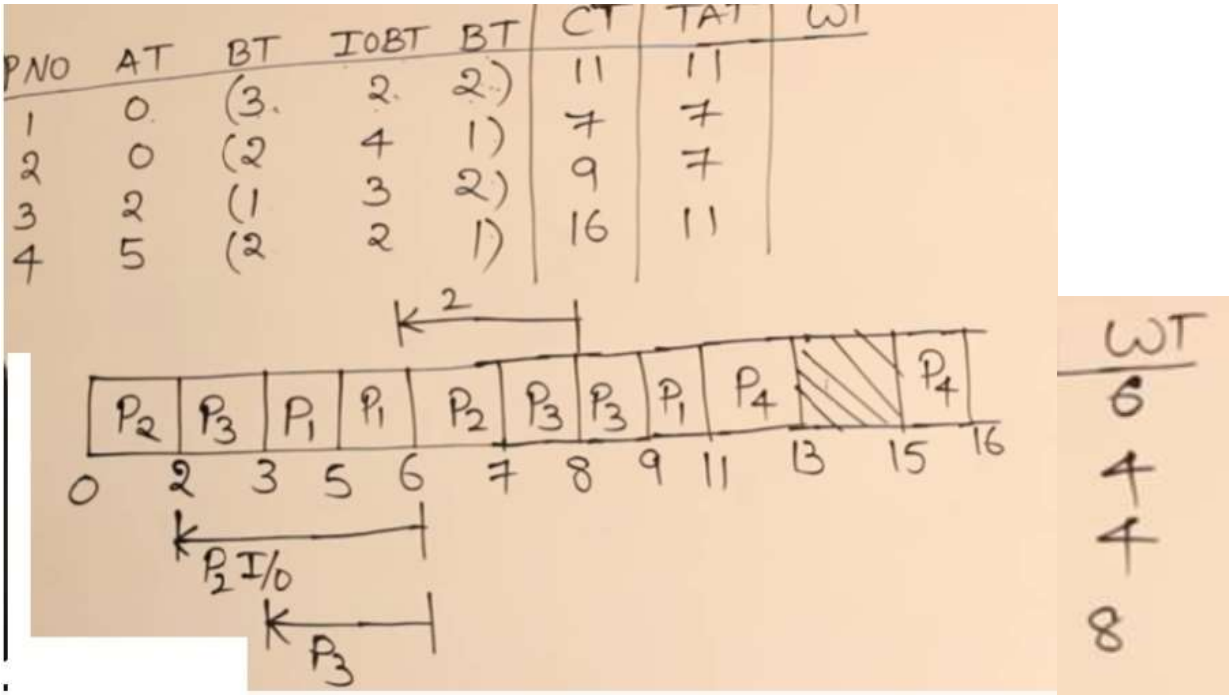
b) The number of kernel threads allocated to the program is equal to the number of processors.

All the processors will be busy and properly utilized with all kernel threads running.

c) The number of kernel threads allocated to the program is greater than the number of processors but less than the number of user level threads

All of the processes will be working simultaneously assuming there are enough user threads. If a kernel thread is blocked, it may be swapped out for one that isn't blocked.

4.



Average Waiting Time =(6+4+4+8) / 4 = 22 / 4 = 5.5

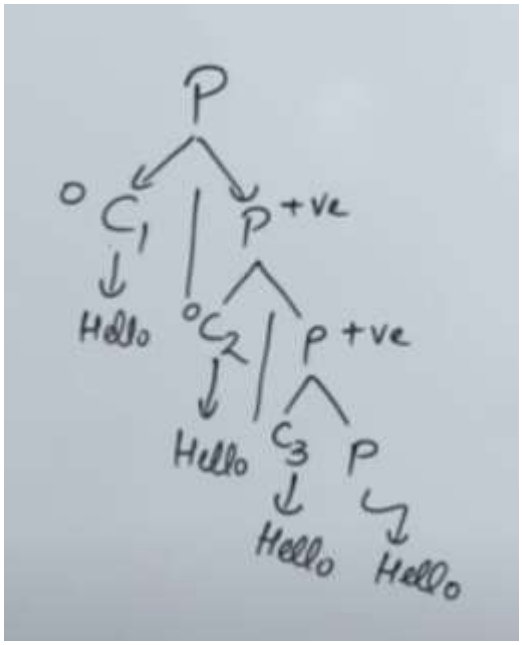
Average Turnaround Time=(11+7+7+11)/4 =36/4= 9

5. What will be the output of the following program? Justify your answer with proper explanations.

[1 MARK FOR OUTPUT AND 1 MARK FOR JUSTIFICATION]

a)

```
hellohellohellohello
```



b) the program that will create 20 threads .

each of which prints out a hello message and its own thread ID.

Also, make the main thread sleep for 1 second for every 4 or 5 threads it creates and show how the execution of the threads interleaves.

```
 I am thread 3678164800. Created new thread (3669776128) in iteration 0 ...
Hello from thread 3669776128 - I was created in iteration 0 !

 I am thread 3678164800. Created new thread (3659187968) in iteration 1 ...
Hello from thread 3659187968 - I was created in iteration 1 !

 I am thread 3678164800. Created new thread (3650795264) in iteration 2 ...
Hello from thread 3650795264 - I was created in iteration 2 !

 I am thread 3678164800. Created new thread (3642402560) in iteration 3 ...
Hello from thread 3642402560 - I was created in iteration 3 !

 I am thread 3678164800. Created new thread (3634009856) in iteration 4 ...
Hello from thread 3634009856 - I was created in iteration 4 !

 I am thread 3678164800. Created new thread (3556767488) in iteration 5 ...
Hello from thread 3556767488 - I was created in iteration 5 !

 I am thread 3678164800. Created new thread (3548374784) in iteration 6 ...
Hello from thread 3548374784 - I was created in iteration 6 !

 I am thread 3678164800. Created new thread (3539982080) in iteration 7 ...
Hello from thread 3539982080 - I was created in iteration 7 !

 I am thread 3678164800. Created new thread (3531589376) in iteration 8 ...
Hello from thread 3531589376 - I was created in iteration 8 !

 I am thread 3678164800. Created new thread (3523196672) in iteration 9 ...
Hello from thread 3523196672 - I was created in iteration 9 !

 I am thread 3678164800. Created new thread (3514803968) in iteration 10 ...
Hello from thread 3514803968 - I was created in iteration 10 !

 I am thread 3678164800. Created new thread (3506411264) in iteration 11 ...
Hello from thread 3506411264 - I was created in iteration 11 !

 I am thread 3678164800. Created new thread (3498018560) in iteration 12 ...
Hello from thread 3498018560 - I was created in iteration 12 !

 I am thread 3678164800. Created new thread (3489625856) in iteration 13 ...
Hello from thread 3489625856 - I was created in iteration 13 !

 I am thread 3678164800. Created new thread (3481233152) in iteration 14 ...
Hello from thread 3481233152 - I was created in iteration 14 !

 I am thread 3678164800. Created new thread (3472840448) in iteration 15 ...
Hello from thread 3472840448 - I was created in iteration 15 !

 I am thread 3678164800. Created new thread (3464447744) in iteration 16 ...
Hello from thread 3464447744 - I was created in iteration 16 !

 I am thread 3678164800. Created new thread (3456055040) in iteration 17 ...
Hello from thread 3456055040 - I was created in iteration 17 !

 I am thread 3678164800. Created new thread (3447662336) in iteration 18 ...
Hello from thread 3447662336 - I was created in iteration 18 !

 I am thread 3678164800. Created new thread (3439269632) in iteration 19 ...
Hello from thread 3439269632 - I was created in iteration 19 !
```