Birla Institute of Technology & Science, Pilani
Second Semester 2019-2020

Comprehensive Exam

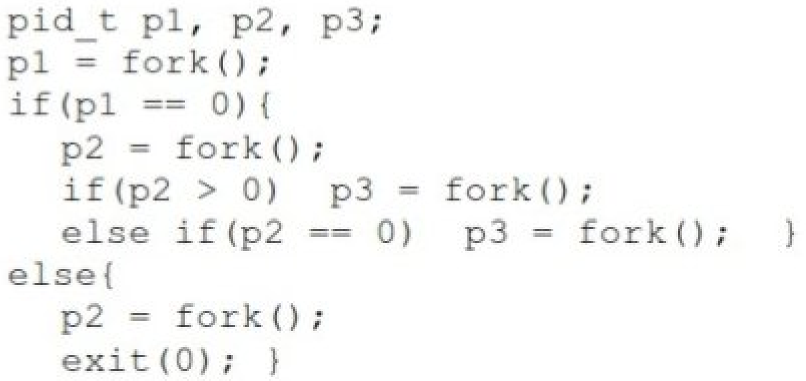
Course No.	: CS F372
Course Title	: Operating Systems
Nature of Exam	: Open Book
Weightage	: 60 Marks
Duration	: 120 Minutes from 10.00 AM to 12.00 PM.
Date of Exam	: 30-11-2020

No. of Pages = 3
No. of Questions = 6

Note:

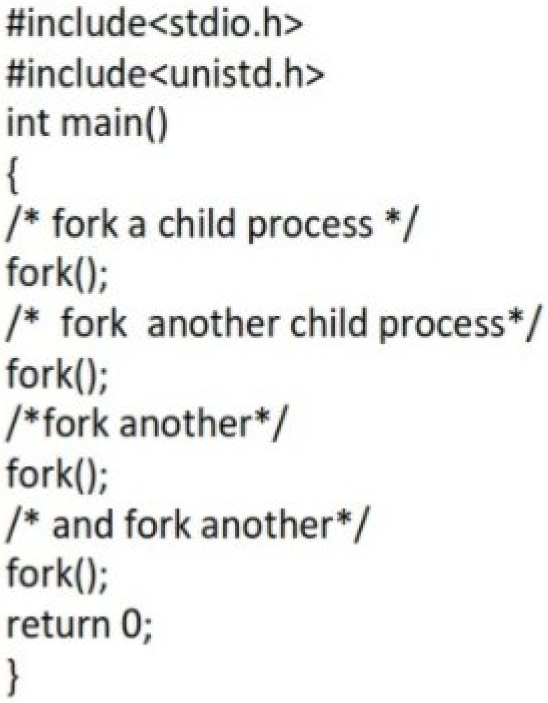
1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.
3. Assumptions made if any, should be stated clearly at the beginning of your answer.
4. Total marks after evaluation would be scaled to 135.

1. a) How many processes can be created by the code shown below? [4M]



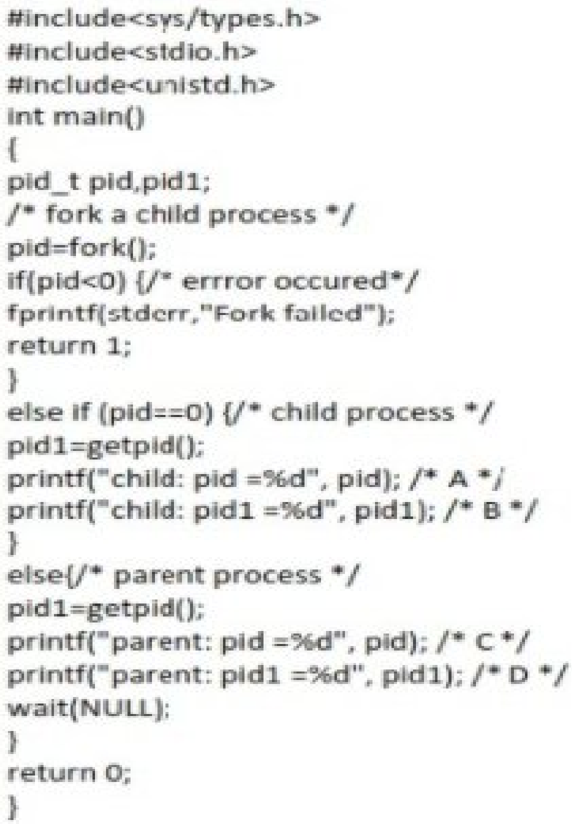
```
pid_t p1, p2, p3;
p1 = fork();
if(p1 == 0){
   p2 = fork();
   if(p2 > 0)  p3 = fork();
   else if(p2 == 0)  p3 = fork();  }
else{
   p2 = fork();
   exit(0); }
```

b) Including the initial parent process, how many processes can be created by the program shown below?. [4M]



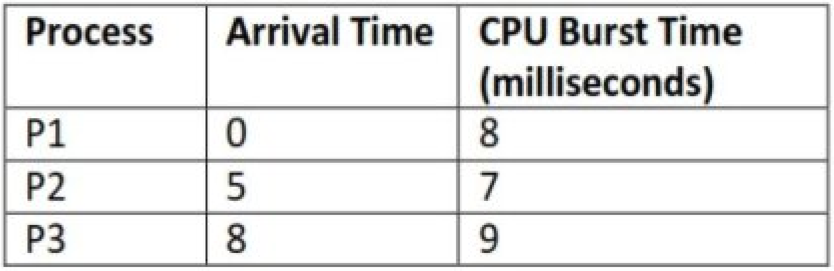
```
#include<stdio.h>
#include<unistd.h>
int main()
{
/* fork a child process */
fork();
/*  fork  another child process*/
fork();
/*fork another*/
fork();
/* and fork another*/
fork();
return 0;
}
```

c) Using the program shown below, display the values of pid at lines A, B, C, and D. (Assume that the actual pids of the parent and child are 3600 and 3603, respectively.) [2M]



```
#include<sys/types.h>
#include<stdio.h>
#include<unistd.h>
int main()
{
pid_t pid,pid1;
/* fork a child process */
pid=fork();
if(pid<0) {/* errror occured*/
fprintf(stderr,"Fork failed");
return 1;
}
else if (pid==0) {/* child process */
pid1=getpid();
printf("child: pid =%d", pid); /* A */
printf("child: pid1 =%d", pid1); /* B */
}
else{/* parent process */
pid1=getpid();
printf("parent: pid =%d", pid); /* C */
printf("parent: pid1 =%d", pid1); /* D */
wait(NULL);
}
return 0;
}
```

2. a) Consider the set of processes (shown in the below table) along with their arrival time and CPU burst time in milliseconds. Calculate the number of context switches if Round Robin scheduling algorithm is used. Time quantum duration is 2 milliseconds. Assume context switches occur even if a single process is present in the ready queue and no new process enters the system after P3. [5M]



Process	Arrival Time	CPU Burst Time (milliseconds)
P1	0	8
P2	5	7
P3	8	9

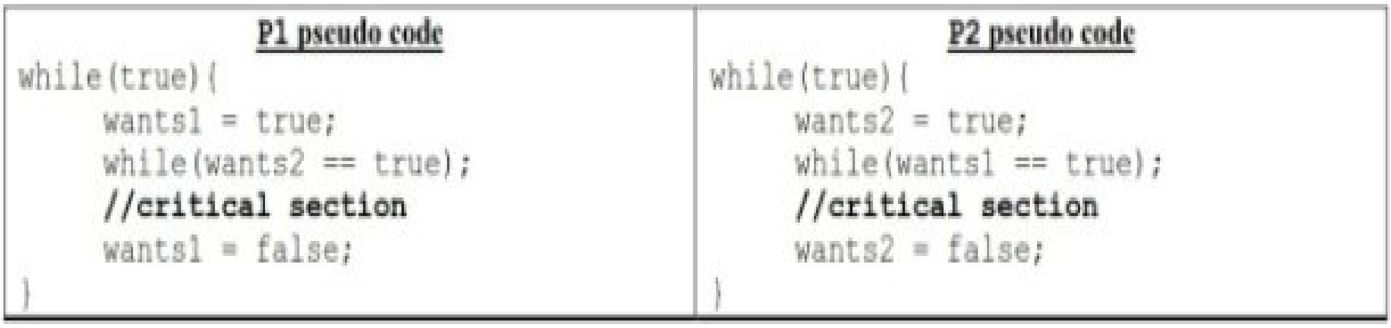
b) Discuss how the following pairs of scheduling criteria conflict in certain settings.

i) CPU utilization and response time.

ii) Average turnaround time and maximum waiting time. [5M]

3. a) Differentiate between Process and Thread. [5M]

b) Two processes, P1 and P2, need to access the critical section. The pseudo codes of P1 and P2 are shown below. Here, wants1 and wants2 are shared variables, which are initialized to false. Does this solution satisfy mutual exclusion? Give proper explanation. [5 M]



P1 pseudo code

```
while(true){
    wants1 = true;
    while(wants2 == true);
    //critical section
    wants1 = false;
}
```

P2 pseudo code

```
while(true){
    wants2 = true;
    while(wants1 == true);
    //critical section
    wants2 = false;
}
```

4. Provide an example of demonstrating processes entering into a deadlock state. Discuss the ways of recovering from Deadlock state.? [4M]

5. Given four memory partitions of 100KB,500KB,200KB, 300KB, and 600KB (in order), how would the first fit, best fit, and worst-fit algorithms place processes of 212KB, 417KB, 112KB, and 426KB (in order)? Which algorithm makes the most efficient use of memory.? [6M]

6. For the given page reference string:1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6, How many page faults would occur for the page replacement algorithms, Least Recently Used (LRU), and First-in-First-Out?. Assume that there are 3 frames (3 pages can be in memory at a time per process). Remember that all frames are initially empty, so your first unique pages will cost one fault each. [8M]

7. Some systems provide file sharing by maintaining a single copy of a file; other systems maintain several copies, one for each of the users sharing the file. Discuss the relative merits of each approach. [6M]

8. Consider a disk queue with I/O requests to blocks on the following cylinders — 28, 5, 128, 34, 54, 9, 156, 36, 110, 232, 187, 132, 99. Currently the head is at cylinder 32. The system uses Shortest-Seek-Time-First (SSTF) disk scheduling algorithm. Assume that the range of cylinder numbers on the disk is from 0 to 299. [6M]

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