How many child processes would be created for the following C-code

```
for( i=0; i<2;i++)
fork( );
fork( );
```

What conditions a solution to the critical section problem must satisfy? How does Peterson's solution satisfy the conditions? Explain.

Why it is difficult to implement SJF scheduling algorithm? Define the formula to predict the next CPU burst in SJF algorithm.

What is a system call? By giving an example, illustrate how system calls are used? Discuss the major categories of system calls.

Explain the evolution of an operating systems by defining the essential properties of Multiprogramming systems, Time sharing systems, Distributed systems, Real time systems, and Handheld systems.

Consider the following set of processes, with the length of the CPU burst time given in milliseconds.

Process	Arrival time	Burst time
P1	0	8
P2	1	14
P3	1	5
P4	2	10

(2)

Draw Gantt Charts to illustrate the execution of above process by using the scheduling algorithm FCFS, SJF preemptive, SJF non-preemptive and Round Robin with quantum 4. Also find the average turnaround time and average waiting time for each algorithm of scheduling.

Explain the working of semaphore operations with no busy waiting. Using semaphores, write a solution to readers and writers problem of process synchronization.

What are semaphore variables? How can semaphore be implemented to ensure no busy waiting?

Two processes, P1 and P2, need to access a critical section of code. Consider the following synchronization construct used by the processes:

P1	P2

while (true) {
p1_flag = true;
while(P2_flag==true);
Critical Section
p1_flag=false;
Remainder section
}
	while (true) {
	p2_flag = true;
	while(P1_flag==true);
	Critical Section
	P2_flag=false;
	Remainder section
	}

Whether the above code satisfy all requirements for a solution to critical section problem? Justify your answer.

A counting semaphore S is initialized to 10. Then 6 WAIT operations and 4 SIGNAL operations were completed on this semaphore. What would be the resulting value of S?

What information is stored in Process Control Block to support context switching between two processes? What are the different criteria based on which a scheduling algorithm can be evaluated?

If there are 7 processes in a system and 5 is the time quantum, what is the maximum and minimum time a process needs to wait for its execution?

What are the scheduling algorithms which may cause starvation? How do you reduce it, if there is?

Explain the characteristics of multiprocessor operating system.

What is a semaphore? What operations can be performed on a semaphore? What are the differences between binary semaphore and counting semaphore?

What is a critical-section problem and what are the requirements which satisfy the solutions to the critical-section problem? Define how Peterson's solution solves the critical-section problem?

Draw a queuing diagram representation of process scheduling. Define how process move from one queue to other by illustrating Job-queue, Ready-queue and Blocked-queue. What is the need of multiple blocked-queue?

b) Which of the following statement is true?Justify your answer.

i) Binary semaphore has a drawback called busy wait or spin lock.

ii) Binary semaphore is applicable only for two processes

iii) Busy waiting is desirable in multi processing operating system.

How many child processes will be created and how many times "Welcome" will be displayed after execution the following program?

```
int main() {
    fork();
    fork();
    printf("Welcome");
    fork();
    return 0;
}
```

A) 2, 2
B) 3, 4
C) 7, 4
D) 7, 8

How many child processes will be created and how many times "Welcome" will be displayed after execution the following program?

```
int main() {
    int i, j;
    for(i=1, j=7; i<j; i++, j--)
        fork();
    printf("Welcome");
    fork();
    fork();
    return 0;
}
```

A) 15, 8
B) 16, 7
C) 31, 8
D) 32, 7

In which of the following process scheduling policies context switching never take place?

I. Round-robin
II. Shortest job first(non pre-emptive)
III. Pre-emptive
IV. First-cum-first-serve

A) IV only
B) I and III
C) II and III
D) II and IV

Which of the following statement(s) is(are) true?

I. Shortest remaining time first scheduling may cause starvation.
II. Preemptive scheduling never cause starvation.
III. Round robin is better than FCFS in terms of response time.

A) I only
B) I and III
C) II and III
D) I, II , III

Consider three processes: P1, P2 & P3 with CPU burst time 5, 4, 3 time units and arrival time 0, 3, 4 time units respectively. Consider the FCFS and RR (with time slice 2 time units) scheduling algorithms. Find the order of completion of execution of processes in both algorithms.

A) FCFS: P1, P2, P3
RR: P1, P2, P3
B) FCFS: P1, P3, P2
RR: P2, P1, P3
C) FCFS: P1, P2, P3
RR: P1, P3, P2
D) FCFS: P1, P2, P3
RR: P3, P2, P1

A scheduling algorithm assigns priority directly proportional to the remaining burst time of a process. Every process starts with priority zero (the lowest priority). The scheduler re-evaluates the process priorities every execution of process and decides the next process to schedule. Which one of the following is TRUE if the processes have no I/O operations and all arrive at time zero?

A) This algorithm is equivalent to the first-come-first-serve algorithm
B) This algorithm is equivalent to the round-robin algorithm
C) This algorithm is equivalent to the largest-remaining-time-first algorithm
D) This algorithm is equivalent to the shortest-remaining-time-first algorithm

Consider three processes (process id 1, 2, 3 respectively) with arrival time 0, 1, 2 and CPU burst time 6, 3 and 2 time units respectively. Consider the shortest remaining time first (SRTF) scheduling algorithm. In SRTF ties are broken by giving priority to the process with the highest process id. Find the average turn around time.

A) 5 units
B) 6 units
C) 7 units
D) 8 units

The following two concurrent processes P_1 and P_2 that share a variable B with an initial value of 5. What is the sum of all possible values of B?

```
P1 ( ) {                P2 ( ) {
    C = B – 1;              B = 2 * B;
    B = 2 * C;          }
}
```

A) 24
B) 26
C) 42
D) None of the above

The following two concurrent processes P_1 and P_2 that share a variable B with an initial value of 5. What is the GCD of all possible values of B?

```
P1 ( ) {                P2 ( ) {
    C = B – 1;              B = 2 * B;
    B = 2 * C;          }
}
```

A) 1
B) 2
C) 4
D) None of the above

The following two concurrent processes P_1 and P_2 that share a variable B with an initial value of 3. What is the sum of all possible values of B?

```
P1 ( ) {                P2 ( ) {
    C = B – 1;              B = 2 * B;
    B = 2 * C;          }
}
```

A) 18
B) 22

The following two concurrent processes P_1 and P_2 that share a variable B with an initial value of 3. What is the difference between the smallest and largest values of all possible values of B?

```
P1 ( ) {                P2 ( ) {
    C = B – 1;              B = 2 * B;
    B = 2 * C;          }
}
```

A) 4
B) 6
C) 8
D) None of the above

Consider a non-negative counting semaphore S. The operation P(S) decrements S, and V(S) increments S. During an execution, 22 P(S) operations and 14 V(S) operations are issued in some order. The largest initial value of S for which at least one P(S) operation will remain blocked is

A) 7
B) 8
C) 9
D) 10

The Shortest Job First (SJF) process scheduling algorithm leads to the problem of starvation.
Discuss some of the ways to resolve this issue.

There are some similarities between Semaphores and condition variables (of Monitor). What are the major differences between semaphores and condition variables?

Write the pseudo code for Peterson solution to the critical section problem. Explain the correctness of the solution which satisfies the 3 conditions for critical section problem.

Explain the various stages of Process State Transition with a neat diagram.

Implement Reader-Writer problem with reader dominance using Semaphore and Monitor. (Write the Pseudocode)

What do you mean by multilevel feedback scheduling? Briefly describe its characteristics, features, pros and cons of the scheduling algorithm. Explain the algorithm by using a neat diagram with a suitable example.