C3-R3: OPERATING SYSTEMS

NOTE:

1. **Answer question 1 and any FOUR questions from 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

1.

a) Does a process incur more execution overhead compared to a thread? Justify your answer.
b) Distinguish between multiprocessing and multiprogramming.
c) What are the "special files" in Unix?
d) What is the main difference between worm and virus?
e) State the practical limitations of implementing non-preemptive SJF algorithm.
f) What is the difference between a long-term scheduler and a short-term scheduler?
g) How can a single copy of a text editor be used to serve multiple users in a time-sharing system?

(7x4)

2.

a) What is TLB? Find out the effective memory-access time with an 80% hit ratio and the following access times:
TLB access time: 20ns; MM access time: 100ns
b) Describe the public-key encryption scheme and mention how is it advantageous to the data-encryption standard.

(8+10)

3. Consider the following page reference during a given time interval for a memory consisting of 5 frames: y,c,z,c,d,a,y,a,e,a,y,f,d,e. Using the i) FIFO replacement strategy and ii) the LRU replacement strategy compare the results. Repeat both FIFO and LRU replacement strategies for memory with 3 frames and same page reference pattern. Comment on the findings and draw a conclusion justifying the adoption of a particular replacement strategy.

(18)

4.

a) What does 'init' do? What happens to the parent process id of a child when the parent terminates before its child? When does a child become 'zombie'?
b) With reference to Unix when do the following situations occur?
   i) Single process table entry contains pointers to the same file table entry.
   ii) Different file table entries point to the same i-node table entry.
   iii) Shell 'forks' a copy of itself and 'waits' for the child to terminate.
c) How does CPU time-slice affect the Round-Robin algorithm?

(8+6+4)

5.

a) Show and explain an implementation of the classical producer-consumer (producer produces an item, keeps it in a buffer from where the consumer is picking it up) problem using semaphore.

b) What is dynamic loading? Mention its advantage. How is dynamic linking performed? Mention any disadvantage that you can think of for both the schemes.

(10+8)

6.

a) What is meant by a domain and the rights on it? Describe a *Capability list* and ways of protecting it from user tampering.

b) Rewrite the following code introducing code parallelism wherever applicable:

```
For i = 1 to k
      a(i) = b(i) + c(i)
For j = 1 to k
      d(j) = x(j) – y(j)
For p = 1 to k
      x(p) = y(p) + b(p)
read(m,n,o,r)
q = m*n + r/o
write(q)
```

c) Using preemptive SJF(shortest-job-first) algorithm draw the Gannt chart and calculate the average waiting time for the following processes:

Process	Arrival time	Burst time
P_0	0	6
P_1	2	4
P_2	3	10
P_3	7	9

(9+4+5)

7.

a) Where and how “bit vector/table” is used? What are the advantages and disadvantages of the technique?

b) What is deadlock? How can deadlock be prevented by not allowing “Hold and Wait” ? Is it a feasible policy?

c) How can synchronization be achieved when two processes communicate by message passing?

d) Provide a programming example of multithreading giving improved performance over a single-threaded solution.

(5+5+5+3)