University of Vavuniya, Sri Lanka

First Examination in Information and Communication Technology - 2020

Second Semester - December/January - 2022/2023

TICT1233: Operating Systems (Theory)

- ⊙ Answer **four questions** only.
- ⊙ This paper has **five questions** on **four pages**.
- ⊙ Time allowed: **Two Hours**.
- ⊙ Start answering question on a new page

1. (a) Compare and contrast `Application Software` and `System Software`. [10%]

   (b) Define the term `"Operating System"` in your own words and briefly describe any four major functions of an Operating System (OS). [20%]

   (c) Discuss any three problems in designing and developing an OS. [10%]

   (d) Briefly describe what is meant by the `kernel` in OS. [20%]

   (e) Discuss the differences between `Linux` and `Windows` OS. [20%]

   (f) Explain the term `"System call"` and briefly describe any two system calls with the aid of examples. [20%]

2. (a) State clearly what is `scheduling` in the process of OS. [10%]

   (b) List any three characteristics of a good scheduling algorithm. [10%]

   (c) Distinguish `pre-emptive scheduling` and `non-preemptive scheduling`. [10%]

   (d) Briefly describe each of the following factors considered as the performance criteria to achieve efficient processor management:

      i. Process utilization. [05%]

      ii. Throughput. [05%]

      iii. Turnaround time. [05%]

      iv. Wait time. [05%]

      v. Response time. [05%]

`[Question 2 continues on the next page]`

(e) A Computer system receives five jobs (program) at different arrival times and burst times as shown in Table 1. For each of the following scheduling algorithms, draw Gantt Charts, and find the average Turnaround time, Wait time, and Response time.

i. First Come First Serve (FCFS). [15%]

ii. Shortest Job First (SJF). [15%]

iii. Round Robin (Quantum = 4ms). [15%]

Table 1 : Process scheduling

Job	Arrival Time (ms)	Burst Time (ms)
J1	0	12
J2	2	4
J3	5	2
J4	8	10
J5	10	6

3. (a) Differentiate the terms **Program** and **Process**. [10%]

(b) The state of a process is defined in part by the current activity of that process.

i. Describe each of the states of a process with an aid of the process's state transition diagram. [20%]

ii. Relate the term **Context Switch** in the context of state transition. [10%]

(c) Briefly explain any three ways to terminate the processes. [20%]

(d) Clearly state the use of **Process Control Block (PCB)**. [10%]

(e) Identify the differences between **User Processes** and **System Processes**. [10%]

(f) In a Multi-Processor System, processes have to wait until the CPU becomes free.

i. Interpret the ways in which the CPU is free so that a new process can be scheduled. [10%]

ii. Describe the term **Swapping** in terms of scheduling. [10%]

4. (a) Define the term "Deadlock" and list four necessary and sufficient conditions for Deadlock to occur. [20%]

(b) Consider a system with seven processes A, B, C, D, E, F, and G, and five resources R, S, T, U, and V. The state of resource allocation and request at a particular time is as follows:

- Process A holds R and requests S and V.
- Process B holds S and requests T.
- Process C holds nothing but request R.
- Process D holds U and requests S and T.
- Process E holds T and requests V.
- Process F holds nothing but request S.
- Process G holds V and requests U.

i. Draw a resource allocation graph for the above scenario. [20%]

ii. Find whether the system is in deadlock or not, if so, which processes are involved in deadlock. [20%]

(c) A computer system has three types of resources R1, R2, and R3. The total number of R1, R2, and R3 are 180, 7 and 16 respectively. The resources are allocated among five processes as shown in Table 2.

Table 2 : Resource Allocation Table

	max-need			Allocated		
P	R1	R2	R3	R1	R2	R3
1	100	2	5	70	2	3
2	50	3	5	35	1	2
3	120	4	7	25	1	3
4	150	2	8	20	1	2
5	130	3	4	10	–	3

Find whether the system is safe or not using Banker's algorithm. If it is safe then give the safe sequence. [40%]

5. (a) Define the following terms:

i. Parent Process [10%]

ii. Child process [10%]

(b) Write a program to find the sum of the even numbers in an array in the parent process and sum of the odd numbers in the array in the child process. (Hint: assume the array A holds numbers from 0 to 10). [30%]

(c) Explain why a parent process terminates the execution of its own child process in the process state transition. [20%]

(d) Write down the output of the following code and briefly explain them. [30%]

```
#include < stdio.h >
#include < unistd.h >
int main()
{
if(fork() || fork());
fork();
printf("1");
return 0;
}
```