Vavuniya Campus of the University of Jaffna

First Examination in Information and Communication Technology - 2015

Second Semester - January/February 2017

ICT1233 Operating Systems

Answer **Five** Questions Only

Allowed Time: **Three hours**

---

1. (a) Describe what is meant by *Virtual Machine*. [20%]

   (b) Distinguish between *Batch Processing System* and *Real Time Processing System*. [20%]

   (c) Describe briefly what is meant by *Daemons* in Operating Systems. [20%]

   (d) Explain the use of *Registers* and *Drivers* in Computer Systems. [20%]

   (e) Briefly explain the Layered Architecture of an Operating System (OS) with the aid of a diagram. [20%]

2. (a) Differentiate *Process* and *Thread* with respect to OS. [20%]

   (b) Describe briefly each of the *state transitions* of seven-state process model. [20%]

   (c) Describe four different ways to initiate a process. [20%]

   (d) Describe the use of *SUDO* command in Linux OS. [20%]

   (e) Clearly explain the use of *Process Control Block* (PCB) in OS. [20%]

3. (a) State what is meant by *Shared Memory* in OS. [10%]

   (b) Describe the pros and cons of using Shared Memory. [20%]

   (c) Describe briefly what do you understand by *Critical Section* with regard to resource sharing. [20%]

   (d) Explain how *Named Pipes* and *Message Queues* are used in Inter Process Communication. [30%]

   (e) Describe the usage of Semaphores in OS. [20%]

4. (a) Differentiate *CPU bounded* and *I/O bounded* processes. [20%]

   (b) Describe the different principles required to consider while selecting a scheduling algorithm. [20%]

   (c) The table below shows the arrival time and burst time of four processes: A, B, C and D. Process switching overhead is 2s.

Process	Arrival time (s)	Burst time (s)
A	0	10
B	1	25
C	2	35
D	3	20

   For each of the following scheduling algorithms. draw the Gantt chart by considering the process switching overhead, and determine the mean process turnaround time:

   i. *Shortest Job First* [20%]

   ii. *First In First Served* [20%]

   iii. *Shortest Remaining Time Next with Time Quantum = 10s* [20%]

5. (a) Describe briefly *Stack* and *Heap* memories of a process. [10%]

   (b) By using a diagram, illustrate how Stack and Heap grow in main memory. [10%]

   (c) Discuss the pros and cons of using bit-map memory representation. [20%]

   (d) Calculate the space required for the bit-map representation of the main memory of size 4GB divided into 4 Byte units. [10%]

   (e) Differentiate *First-fit* and *Next-fit* mapping algorithms. [20%]

   (f) Trace the *First-In-First-Out* page replacement algorithm for a main memory with four page frames, and the pages are referenced in the following order, assuming that initially no pages were in the main memory:

   0, 2, 3, 2, 4, 5, 2 , 4, 6, 7, 8, 5, 4, 2, 0

   Clearly show the output for each of the steps. [30%]

6. (a) Describe the possible ways used to recover from a *Resource Deadlock*. [20%]

   (b) Resource request and release sequence of three processes are given in Table 1:

A	B	C
Request R	Request T	Request R
Request S	Release T	Request S
Release R	Request R	Release S
Request T	Release R	Request T
Release T	Request S	Release R
Release S	Release S	Release T

Table 1: Resource Request and Release sequences of three processes A, B, and C.

   i. Draw a *Resource Allocation Graph* for the following schedule by assuming that one request or release operation per allowed time:

   A, A, B, C, A. C, A, C, B, A, C, B, B, A, B, C, B, C. [20%]

[To be continued...]

ii. Find whether this system is in a deadlock state, if so, identify the processes and resources involved in deadlock. [20%]

(c) The existence vector E, the current allocation matrix C, and the current request matrix R, of three processes (P_1, P_2, and P_3) and five resources (R_1, R_2, R_3, R_4, and R_5) are as follows:

$$E = \begin{array}{c} \begin{array}{ccccc} R_1 & R_2 & R_3 & R_4 & R_5 \end{array} \\ \begin{pmatrix} 5 & 8 & 6 & 7 & 8 \end{pmatrix} \end{array}$$

$$C = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array} \begin{array}{c} \begin{array}{ccccc} R_1 & R_2 & R_3 & R_4 & R_5 \end{array} \\ \begin{pmatrix} 2 & 2 & 1 & 2 & 2 \\ 0 & 3 & 2 & 1 & 3 \\ 1 & 2 & 2 & 1 & 2 \end{pmatrix} \end{array}$$

$$R = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \end{array} \begin{array}{c} \begin{array}{ccccc} R_1 & R_2 & R_3 & R_4 & R_5 \end{array} \\ \begin{pmatrix} 2 & 4 & 2 & 0 & 1 \\ 1 & 3 & 2 & 1 & 1 \\ 1 & 3 & 2 & 1 & 2 \end{pmatrix} \end{array}$$

Apply *Banker's algorithm* and find whether the state is *safe* or *unsafe*. [40%]