University of Vavuniya

Second Examination in Information Technology - 2019

Second Semester - April / May 2021

(Held on December 2021 / January 2022)

IT2244 Operating Systems (Theory)

Answer Four Questions Only

Time Allowed: Two hours

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1. (a) Explain briefly the necessities of **Process Control Block** for process management in Operating Systems (OS). [10%]

   (b) Clearly describe how a **process** becomes **orphan** in OS. [15%]

   (c) Draw a diagram to illustrate the **life cycle of a process** in OS, and briefly describe each stage. [20%]

   (d) Compare and contrast **Process** and **Thread** in OS. [20%]

   (e) Explain how **Race Condition** occurs in process scheduling with the aid of an example. [25%]

   (f) Briefly describe the use of **Semaphore** in OS for avoiding race condition. [10%]

2. (a) State what is meant by **process switching**, and why is it expensive? [10%]

   (b) Differentiate **CPU bounded** and **I/O bounded** processes. [10%]

   (c) Calculate the CPU time waste (in %) in **Round Robin scheduling** , if the quantum time is 6 milli seconds, and context switch is 2 milli seconds. [15%]

[This question is continued on next page]

(d) Define each of the following terms in process scheduling: ***burst time***, ***waiting time***, ***turnaround time***, *and* ***throughput*** . [10%]

(e) The table below shows the arrival time and burst time of four processes A through E.

Process	Arrival time (s)	Burst time (s)
A	0	8
B	1	9
C	2	15
D	3	10
E	3	5

Draw the gantt chart and determine the mean process **turnaround time** for each of the following scheduling algorithms. Ignore process switching overhead.

i. Round Robin (Quantum = 3s) [15%]

ii. First in First Out (FIFO) [15%]

iii. Multi level queue with three queues (Q0 – time quantum 4s, Q1 – time quantum 8s, Q2 – FIFO). [25%]

3. (a) Explain importance of **base and limit registers** in memory management. [10%]

(b) Briefly explain the use of **Translation Look-aside Buffer** (TLB) in memory management. [10%]

(c) A computer system uses virtual memory of 512MB in size and the main memory of 256MB in size, A Page frame is 32MB in size.

i. Calculate the number of pages. [10%]

ii. Find the number of frames [10%]

iii. If an address locates 4 Byte slot (32-bits) .

A. Find the number of addresses in a frame. [10%]

B. What is the size of a virtual address? [10%]

C. What is the size of a physical address? [10%]

[This question is continued on next page]

iv. If the pages are referenced in the following order, trace the **Least Recently Used** (LRU) page replacement algorithm. Assume no frames were initially present in the main memory.

0, 2, ,3 , 6, 4, 0, 4, 6 , 4, 6, 5, 10, 4, 8, 12, 7, 9, 6

Clearly show the output of each step. [30%]

4. (a) List and describe the four conditions for the Deadlock to occur. [20%]

(b) Consider a time sharing system with three processes A through C, and four resources R through T. The Request release sequence of each process is given below:

- Process A: Request R, Request T, Request S, Release T, Release S, Release R
- Process B: Request T, Request R, Release T, Request S, Release S, Release R
- Process C: Request T, Request S, Release T, Request R, Release R, Release S

The following are two schedules for the processes A, B, and C. During its allotted time a process may either request or release a resource.

- Schedule 1: A, A, B, B, C, C, A, A, B, B, C, C, A, A, B, B, C, C
- Schedule 2: A, B, C, A, B, C, A, B, C, A, B, C, A, B, C, A, B, C

Draw the Resource allocation graph and predict whether any schedule leads to deadlock. [25%]

(c) Given a Bitmap representation of a memory as 1001 0011 1000 0011 1110 1000 0111 1000, where the allocation unit size is 2 KB.

i. Calculate the total size of the memory. [05%]

ii. Sketch the memory indicating used and free slots. [10%]

iii. Represent the memory using Linked list. [10%]

iv. Show the Bitmap representation of the memory after performing each of the following memory allocation methods to place a 4 KB process:

A. first fit [10%]

B. best fit [10%]

C. worst fit [10%]

[Question is continued on next page]

5. (a) List and describe any five **file operations**. [15%]

(b) Define the following terminologies in Disk Management:

i. Drive

ii. Volume

iii. Cylinder

iv. Sector

v. Seek time [25%]

(c) Explain how Ransomware affects a computer system. [20%]

(d) You are given an Existence vector E, Current allocation matrix C, and Request matrix R, as follows:

$$E = \begin{pmatrix} 5, & 8, & 6, & 7, & 8 \end{pmatrix}$$

Current Available. $A = \begin{pmatrix} 2, & 2, & 1, & 3, & 1 \end{pmatrix}$

$$C = \begin{pmatrix} 2, & 2, & 1, & 2, & 2 \\ 0, & 2, & 2, & 1, & 3 \\ 1, & 2, & 2, & 1, & 2 \end{pmatrix}$$

$$R = \begin{pmatrix} 2, & 2, & 2, & 3, & 2 \\ 1, & 5, & 2, & 1, & 1 \\ 1, & 3, & 2, & 1, & 2 \end{pmatrix}$$

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

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