University of Ruhuna - Faculty of Technology
Bachelor of Information & Communication Technology Degree
Level 2 (Semester 2) Examination, April 2019

Course Unit: ICT2213- Operating System Concepts and Applications (Theory Examination)

Answer all four (04) questions

Time Allowed: 2 hours

IMPORTANT INSTRUCTIONS

- The medium of this examination is **English**
- This paper contains four (04) questions on Three (03) pages.

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(1)

a) Briefly explain the role of Operating System as a "Resource Allocator" using two suitable examples.

b) List three advantages of multiprocessor systems.

c) Briefly explain the following terms in one or two sentences.

   i) Mode-bit in dual mode operation.

   ii) Address binding.

   iii) Shared memory.

   iv) Race condition.

d) Briefly explain the microkernel system structure. Give one advantage and disadvantage of it.

e) Briefly explain the term "caching" in a computer system by highlighting its importance.

(2)

a) State the main difference between a program and a process.

b) Identify a, b and c which are different states of a process.

$$new \rightarrow a \rightarrow b \rightarrow c \rightarrow a \rightarrow b \rightarrow terminate$$

c) "Non-preemptive scheduling is mostly suitable for foreground processes than for background processes". Clearly state whether you agree with this statement or not and justify your answer.

d) How many x values will be printed from the following program? Draw a sketch of a flow chart to show how new processes are created.

```
#include<stdio.h>
#include<unistd.h>
void main(){
        int x=10;
        fork();
        fork();
        fork();
        printf("X=%d",x);
}
```

e) A multilevel feedback queue contains the following configuration:

- Composed of three queues.
- Queue1 has round robin scheduler with time quantum 5ms.
- Queue2 has round robin scheduler with 10ms.
- Queue3 has First Come First Serve scheduler.
- Newly entered process will be first placed at Queue1.
- If it is not finished in a single execution, then it will be placed at Queue2.
- If still it is not finished in the first iteration at Queue2, then finally it will be placed at Queue3.
- Processes in Queue2 will be executed only if Queue1 is empty and processes in Queue3 will be executed only when Queue1 and Queue2 are empty.

The system consists of four processes and their arrival and burst times are given below. Consider the above scenario and answer the following questions.

Process	Arrival time	Burst time
A	4	10
B	0	25
C	8	4
D	20	15
E	7	8

i) Draw the Gannt chart to illustrate the execution of processes given above.

ii) Find the average waiting time of the system.

(3)

a) What are the four necessary conditions for a deadlock to occur?

b) Consider the following instance of a system with 4 processes (P1, P2, P3 and P4) and three resources (R1, R2 and R3). There are 8 instances of R1, 5 instances of R2 and 6 instances of R3.

Process	Maximum Demand			Current Allocation			Need		
	R1	R2	R3	R1	R2	R3	R1	R2	R3
P1	2	3	1	1	1	0			
P2	1	0	3	0	0	2			
P3	4	1	2	3	1	1			
P4	1	4	2	1	3	0			

i) Fill the values of "Need" column.

ii) Calculate the number of resource instances available in R1, R2 and R3.

iii) Find whether below given sequences are safe states or not. Show the steps.

    1. P1, P2, P3, P4

    2. P3, P1, P2, P4

    3. P2, P3, P4, P1

c) Assume that two processes and two resources are in the system. Draw a resource allocation graph with a cycle and without a deadlock.

d) Consider the following page reference string.

    3, 0, 5, 1, 3, 6, 7, 8, 4, 0, 7, 9, 4, 5, 6, 0, 2

Determine the number of page faults that can occur for the following page replacement algorithms when there are four frames in the main memory.

i) FIFO replacement.

ii) Least Recently Used replacement.

(4)

a) Briefly explain the internal and external fragmentation using suitable diagrams.

b) Briefly explain "thrashing" with respect to virtual memory.

c) List two differences between single-level and two-level directory structures.

d) With the aid of a suitable diagram, briefly explain the linked file allocation technique. Give one advantage of it.

e) What is the difference between synchronous and asynchronous I/O methods?

f) Explain "domain switching" in system protection using an example in access matrix.

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