UNIVERSITY OF BOTSWANA

DEPARTMENT OF COMPUTER SCIENCE

Test I

COURSE NO: CSI354

TITLE OF PAPER: OPERATING SYSTEMS

TITLE OF EXAMINATION: BSC III **SUBJECT:** COMPUTER SCIENCE

DATE: SEPTEMBER 2022 **DURATION:** 1 HR 30MINS

INSTRUCTIONS:

ANSWER ALL QUESTION.

TOTAL MARKS: 54

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NUMBER OF PAGES (including cover page) **3**

Question 1 (15 Marks)

a) Describe the following scheduler concepts:

i. Turnaround Time **[2 marks]**

ANS: Amount of time to execute a process

ii. Response Time **[2 marks]**

ANS: Amount of time it takes from when a request was submitted until the first response is produced, not output (for time-sharing environment)

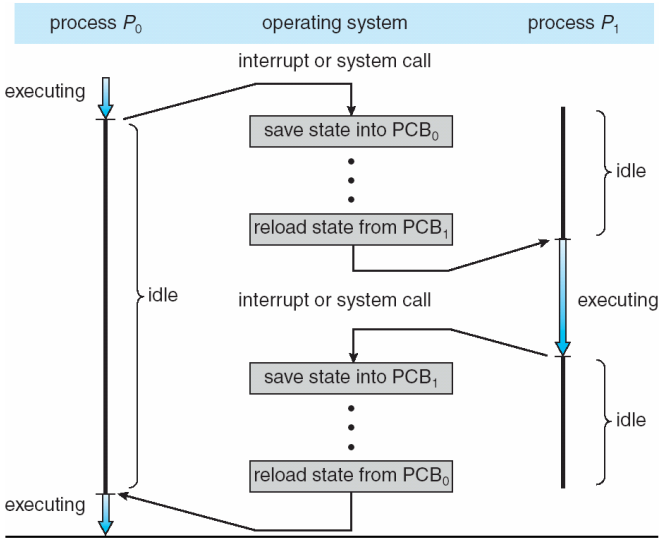
iii. Throughput **[2 marks]**

ANS: # of processes that complete their execution per time unit

iv. Dispatch Latency **[2 marks]**

ANS: Time it takes for the dispatcher to stop one process and start another running.

b) Describe how Context Switching occurs (Show all steps incurred). **[3 marks]**



c) Explain why Thread switching is considered less costly compared to switching of Processes? **[3 marks]**

ANS:

- **Threads share same address space as that of the process that initiated it.**
- **Threads make use of caching technique - Threads accessing the same data can now have private copies of the data in their local cache.**

- **Economical**
- **Scalable**
- **Resource sharing.**

d) What is meant by context switching overheads? **[1 mark]**

ANS: Time wasted while CPU is doing nothing but saving context of a process and reloading another process.

Question 2 **(15 Marks)**

a) Differentiate between local procedure calls and remote procedure calls.**[4 marks]**

ANS:

LPC: Internal within one system. Uses ports like mailboxes to establish and maintain communication channels.

RPC: Between systems on a networked environment.

Uses the stub – client-side proxy for the actual procedure on the server

Stub is a piece of code used to convert parameters during a remote procedure call (RPC). An RPC allows a client computer to remotely call procedures on a server computer. The parameters used in a function call have to be converted because the client and server computers use different address spaces. Stubs perform this conversion so that the remote server computer perceives the RPC as a local function call.

b) Justify the need for a hybrid Threading model. **[2 marks]**

ANS:

- **Overcome limitations of one-level models**
- **Flexibility when assigning user level threads to kernel level threads**

c) For each of the following operations, indicate whether each could cause an Interrupt (I), generates a Trap (T), or does Neither (N). **[8marks]**

i. Disk device controller signaling the completion of a block write **- I**
ii. Procedure call **- N**
iii. Writing to a device I/O register **- N**
iv. System call **- T**

d) State one reason why symmetric multiprocessing is complex to design compared to asymmetric processing systems? **[1 mark]**

ANS: Balancing work among multiple CPU requires complex programming to

achieve vs focusing on one master processor to assign others work.

Question 3 (24 Marks)

a. Given the following list of processes and CPU burst times;

Process	Burst Time
P1	13
P2	5
P3	23
P4	3
P5	31
P6	3
P7	14

Calculate the average waiting time for each of the following scheduling algorithms. Assume a time quantum of 8 is being used.

i. First Come First Served (FCFS) **[4 marks]**

FCFS

Process	Burst Time	Wait Time
P_1	13	0
P_2	5	13
P_3	23	18
P_4	3	41
P_5	31	44
P_6	3	75
P_7	14	78

The average wait time is calculated as

ΣWaitTime / No Of Processes
= (0 + 13 + 18 + 41 + 44 + 75 + 78) / 7
= 269 / 7
= **32.43**

ii. Shortest Job First (SJF), non-preemptive **[4 marks]**

SHORTEST JOB FIRST

Process	Burst Time	Wait Time
P_6	3	0
P_4	3	3
P_2	5	6
P_1	13	11
P_7	14	24
P_3	23	38
P_5	31	61

The average wait time is calculated as

ΣWaitTime / No Of Processes
= (0 + 3 + 6 + 11 + 24 + 38 + 61) / 7
= 143 / 7
= **20.43**

iii. Round Robin (Time Quantum = 8) **[4 marks]**

ROUND ROBIN (Q=8)

	P1	P2	P3	P4	P5	P6	P7
	8	5	8	3	8	3	8
	5		8		8		6
			7		8		
					7		
Waiting Times	**35**	**8**	**54**	**21**	**61**	**32**	**56**

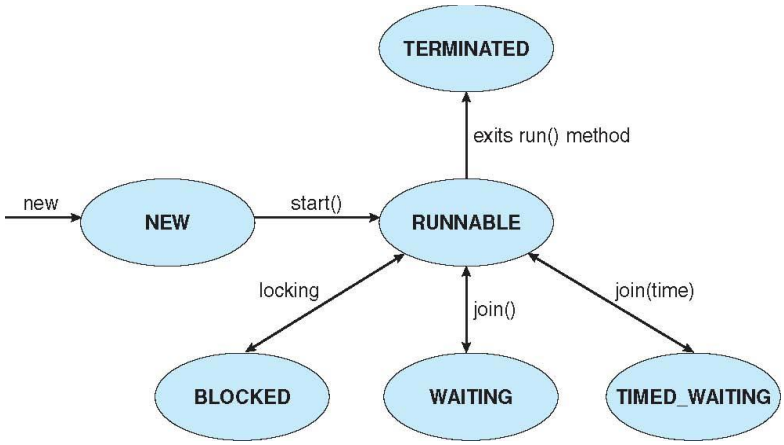
Avg. waiting time = 35+8+54+21+61+32+56/7
= 267/7
= 38.1

b. Describe One technique used to avoid indefinite waiting for system resources. **[1 mark]**

ANS: Aging

c. Illustrate (by drawing), all Java Thread States and their associated transitions. **[8 marks]**

ANS:



d. List three ways used to pass parameters to a system call when requesting OS services. **[3 marks]**

ANS:

- **Simplest: pass the parameters in *registers***
- **Parameters stored in a *block,* or table, in memory, and address of block passed as a parameter in a register**
- **Parameters placed, or *pushed,* onto the *stack* by the program and *popped* off the stack by the operating system**

END OF TEST