NATIONAL SCHOOL OF BUSINESS MANAGEMENT
BSc (Hons) in Software Engineering (NSBM)– 20.2/20.3
BSc (Hons) in Computer Science (NSBM)– 20.2/20.3
BSc (Hons) in Computer Networks (NSBM)– 20.2/20.3

2nd Year 1st Semester Examination
**1st June 2022**
CS201.3 – Operating Systems

Instructions to Candidates

1) **Answer ONLY 5 Questions.**
2) Answer ALL questions
3) Time allocated for the examination is three (05) hours (Including downloading and uploading time)
4) Weightage of Examination: 60% out of final grade
5) Download the paper, provide answers to the questions in a word document.
6) Answer script should be uploaded in PDF Format.
7) The Naming convention of the answer script – Module Code_Subject name_Index No
8) Please upload the document with answers (Answer Script) to the submission link before the submission link expires.
9) Under any circumstances E-mail submissions would not be taken into consideration for marking. Incomplete attempt would be counted as a MISSED ATTEMPT.
9) You must adhere to the online examination guidelines when submitting the answer script to N-Learn.
10) Your answers will be subjected to Turnitin similarity check, hence, direct

Question 1 **(20 MARKS)**

1. "Nissan motor company willing to introduce a new automation system for their newest vehicles", what are the key considerations you would suggest on this project as an operating system expert. [4 marks]

2. The following diagram represents the Abstract View of an operating system. Briefly describe the components and the functionality of it. [3 marks]
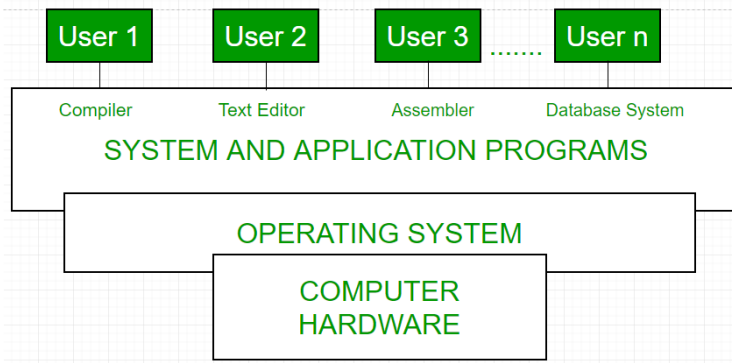
3. Explain the functionality, characteristics, advantages, and disadvantages of the following types of operating systems with a use of an example. (Note: no marks will be given if there is no examples)
   a) Simple Batch Systems
   b) Real Time Operating Systems [6 marks]

4. Describe the states of a process. Your answer should include a brief description of each state. Use diagrams and examples to assist your answer. [4 marks]

5. What is the involvement of the process control block and list down three information contains in it? [3 marks]

Question 2 **(20 MARKS)**

1. CPU switching is an essential event carried out by systems like Time Sharing Systems. Explain the functionality of the CPU switching from one process to another. Use a diagram to assist your answer. [4 marks]

2. Draw Gantt chart to represent the scheduling of the following processes under Shortest Job First and calculate the Average Waiting time and Average Turnaround time for the algorithm. [4 marks]

Process	Arrival Time	Execution Time (Burst)
P0	0	6
P1	1	3
P2	2	1
P3	3	2
P4	5	3

3. Assume a processor with quantum time units of 2, draw a diagram showing how RR (round robin) would schedule the processes for the above processes. What is the average waiting time in this case? [4 marks]

4. Briefly explain the difference between Preemptive Priority scheduling and Non-Preemptive Priority scheduling. Draw the Gantt charts for those to algorithms for below processes and find the best algorithm from those two. [8 marks]

Process	Arrival Time	Execution Time	Priority
P0	0	4	1
P1	1	5	1
P2	1	1	3
P3	2	2	2
P4	3	6	7

Question 3 (20 MARKS)

1. What is the Memory Management Unit (MMU)? [3 marks]
2. Explain the major difference between the Paged Memory Allocation and the Demand Paging? [3 marks]
3. Consider a user program of logical address of size 5 pages and the page size is 4 bytes. The physical address contains 300 frames. The user program consists of 19 instructions a, b, c, . . . r, s . Each instruction takes 1 byte. Assume at that time the free frames are 15, 23, 4, 1, 55, 5, 18, 21, 70, and 78. Find the following?
    a. Draw the logical and physical maps and page tables?
    b. Allocate each page in the corresponding frame?
    c. Find the physical addresses for the instructions d, f, k, r?
    d. Calculate the fragmentation if exist? [6 marks]
4. Explain the following terms using suitable diagrams and mentioned why they occurs in the memory management. [4 marks]
    a) Internal Fragmentation
    b) External Fragmentation
5. Perform an analysis using Optimal policy algorithm for the following string of memory reference addresses. Assume that there are three frames available within the memory for holding pages. Find how many page faults has been occurred. [4 marks]

0	1	2	2	0	3	4	0	2	5	0	4	1	2	0	0	2	4	0	5

Question 4 (20 MARKS)

1. Completes the Remain column of the following Table and apply the "Banker's Algorithm" to find the execution order of the following processes without occurring a deadlock.
   Respective Resource Total of (A, B, C, D) as follows
   Total Resources (3,17,16,12)

	Allocations				Max				Remain				Current Work			
P0	0	1	1	0	0	2	1	0								
P1	1	2	3	1	1	6	5	2								
P2	1	3	6	5	2	3	6	6								
P3	0	6	3	2	0	6	5	2								
P4	0	0	1	4	0	6	5	6								

> Use the following equations for calculations –
>
> - Remain = Max – Allocations
> - Current Work = Total – Allocation Total

[8 marks]

2. Convert the following matrix representation to a resource allocation graph. Use the deadlock detection algorithm to determine whether the system contains a deadlock. Which processes are involved in the deadlock? While you are using the deadlock detection algorithm, add, and remove directed edges of the resource allocation graph. [6 marks]

	Allocation					Request					Available				
	R_1	R_2	R_3	R_4	R_5	R_1	R_2	R_3	R_4	R_5	R_1	R_2	R_3	R_4	R_5
P_1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
P_2	1	0	0	0	0	0	1	1	0	1					
P_3	0	0	1	0	0	0	0	0	0	1					
P_4	0	1	0	0	0	0	0	0	0	0					
P_5	0	0	0	0	1	0	0	0	1	0					

3. Consider the following resource allocation graph.
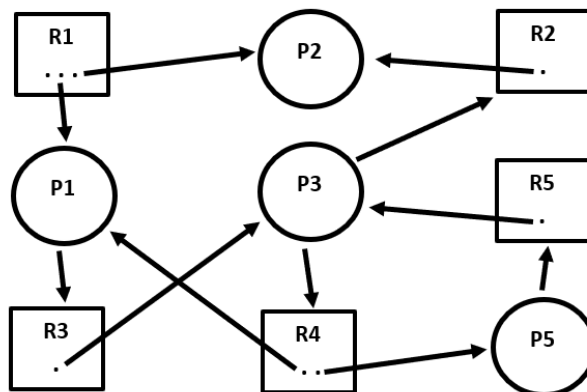
   a) Convert it to the matrix representation (i.e., Allocation, Request and Available).
   b) Do a step-by-step execution of the deadlock detection algorithm. For each step, add and remove the directed edges and redraw the resource allocation graph.
   c) Is there a deadlock? If there is a deadlock, which processes are involved? [6 marks]

Question 5 (20 MARKS)

1. The diagram below represents a network of nodes in a system. The number on each edge represents the length of the path in units.
   Using Kruskal's algorithm, find and redraw a minimum spanning tree for the network in the diagram and state it's total length. (Hint – Starts with the shortest length) [10 marks]
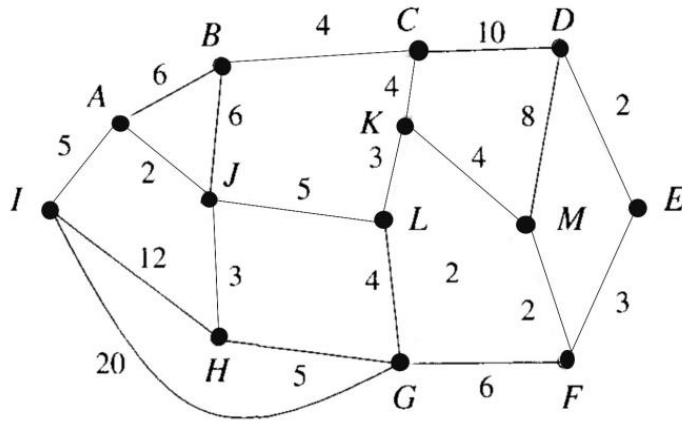
2. Three jobs are needed to be performed on three processors and the time for each processor-job combination is given in the following table. All jobs must be performed by assigning exactly one processor to each job and exactly one job to each processor so that the total time of the assignment is minimized. Find the optimal job assignment using the applicable concepts.

[10 marks]

	Processor 1	Processor 2	Processor 3
Job1	6	8	10
Job 2	15	11	13
Job 3	16	14	17

Question 6 (20 MARKS)

1. Briefly describe User Mode and the Kernel Mode of an operating system with the use of a diagram? [4 marks]
2. Explain what is "Free and Open-Source Systems". [2 marks]
3. Describe the following Linux directory permissions. You need to describe the permissions of all three owners and the type of files. [4 marks]

```
drwxr-xr-x 2 rukshan rukshan 4096 May 16 20:26 Music
-r-----r-- 1 rukshan rukshan   57 May 16 23:22 myinfo
```

4. Write down the Linux commands to complete following.
   a. Print name of current/working directory.
   b. List all directory contents.
   c. Create a new directory of "Covid_data".
   d. Create a new text file name "Patients.txt" inside directory "Covid_data" and write five lines in it.
   e. Print first three lines of the document.
   f. Print all the five lines with line numbers.
   g. Create a copy of the "Patients.txt" and name it "Patientscpy.txt".
   h. Change the permission of the "Covid_data" to following parameters

      User – Write, Read and Execute

      Group – Execute only

      Other – Write and Execute [10 marks]

   *****END OF THE Paper****