

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, ALLAHABAD
Mid-Semester Examination, September 2018
Date of Exam: 16.09.2018 (1st Session)
Course Title: Operating Systems; Course Code: IOPS332C
Program: B.Tech. (ECE)/Dual Degree 3rd Semester
Paper Setter: Dr. S. MAITY

Full Marks: 30

Duration: 2 Hours

Answer all of the following questions. Clearly write question numbers in your answers.

1. A keyboard controller is an example of an embedded system. Explain. **2 Marks.**
2. Suppose you have a dual boot computer system with both Windows-XP and Ubuntu-14 installed in it. Explain what happens when you turn-on your system? State the major steps. **3 Marks.**
3. You have studied many CPU scheduling algorithms, like – FCFS, SJF, RR, priority scheduling etc. Which of these scheduling algorithms you would suggest for use in a hard real time system, and which algorithm for a soft real time system? Justify your answer. **2 Marks.**
4. We know that, in order to maintain information for a set of processes, an O/S uses a linked list of PCB structures. However, in order to handle interrupts, an O/S uses an interrupt vector which is essentially an array of pointers, where every pointer points to an ISR routine. Why an O/S does not simply use a linked list of ISRs, like the linked list of PCBs, and maintain just a header of that linked list for serving interrupts? **2 Marks.**
5. Suppose the following matrix **S** represents the state transition matrix for a process where a value of '1' in a cell $S[i][j]$ indicates that transition from state i to state j is allowed/possible; the value is '0' otherwise. Fill the matrix with proper values for an O/S which *i*) uses preemptive CPU scheduling, *ii*) uses non-preemptive CPU scheduling. **1.5 + 1.5 = 3 Marks.**

STATES	new	ready	running	waiting	terminated
new					
ready					
running					
waiting					
terminated					

State Transition Matrix S

6. In an O/S, that uses a microkernel, most of the O/S services are run at the user space. Then how a microkernel based system provides better system security than a macro-kernel based system? **2 Marks.**
7. Normally, when a privileged instruction is attempted to run in user space, the H/W generates a trap. But, when we install an operating system X inside another operating system Y by creating a virtual machine, all processes of X run in the user mode only. However, the kernel of the operating system X (like any other O/S kernel) contains privileged instructions! Then, how kernel of X is executed? **4 Marks.**

8. Why a server process usually needs to listen to a well-known port number but, a client process can take any port number (above 1024) dynamically? How an RPC client finds the port number of an RPC daemon if port number binding is dynamic? **1 + 1 = 2 Marks.**

9. Calculate the *i)* average waiting time, and *ii)* average turnaround time for the following set of processes for a) preemptive SJF and b) non-preemptive SJF scheduling. **4 Marks.**

<u>Process</u>	<u>Arrival-Time</u>	<u>Next-CPU-Burst</u>
P1	0	4
P2	5	9
P3	9	6
P4	12	1

10. Consider the following solution for the two-process critical section problem:-

Declaration: boolean flag[2];
Initially: flag[0] = flag[1] = FALSE;

do{

...

```
flag[i] = TRUE;
while(flag[j]);
```

critical section

```
flag[i] = FALSE;
```

...

}while(1);

Structure of Process P_i

Which of the essential requirements of a critical-section solution are satisfied and which are not, by the above solution? Justify your answers. **6 Marks.**

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