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TECHNOLOGICAL UNIVERSITY DUBLIN
KEVIN STREET CAMPUS

BSc. (Honours) Degree in Computer Science (Infrastructure)

Year 4

SEMESTER 2 SUPPLEMENTAL EXAMINATIONS 2020/21

Operating Systems 1

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DURATION: 3 HOURS

ANSWER **All** QUESTIONS

All questions carry equal marks.

A mark of 1% is awarded to each candidate who correctly submits a paper

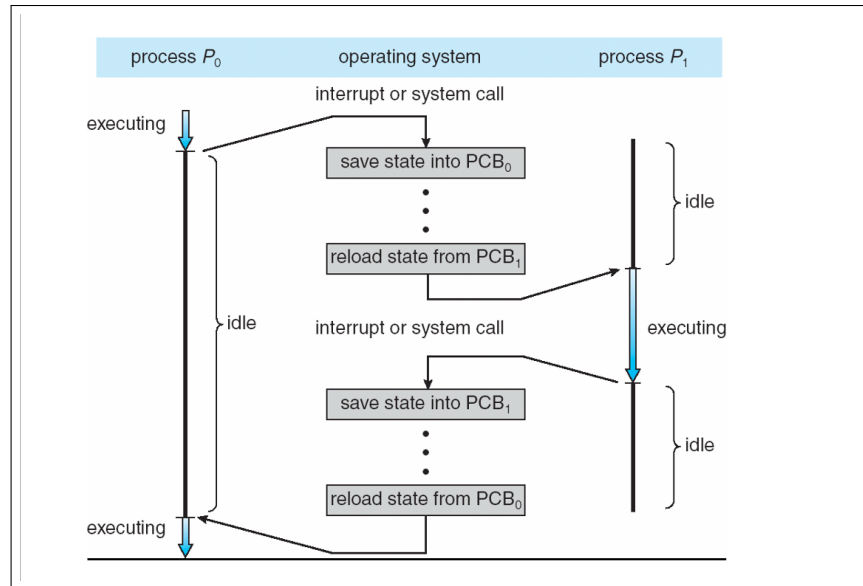


Figure 1: Example execution sequence of two processes under a pre-emptive scheduling policy

1. Figure 1 shows an example of how a process manager using a pre-emptive scheduling policy may execute two processes, A and B .
 - (a) Explain, **in your own words**, why process managers in modern operating systems behave in this way. (12 marks)
 - (b) When deciding how to schedule jobs, a process manager makes a distinction between **batch** processes and **interactive** processes. Explain, in your own words, why these two types of processes are treated differently (15 marks)
 - (c) Explain, in your own words, how the *dining philosopher's problem* as described by Edsger Dijkstra can help us to understand the problem of *deadlock* in an operating system (6 marks)

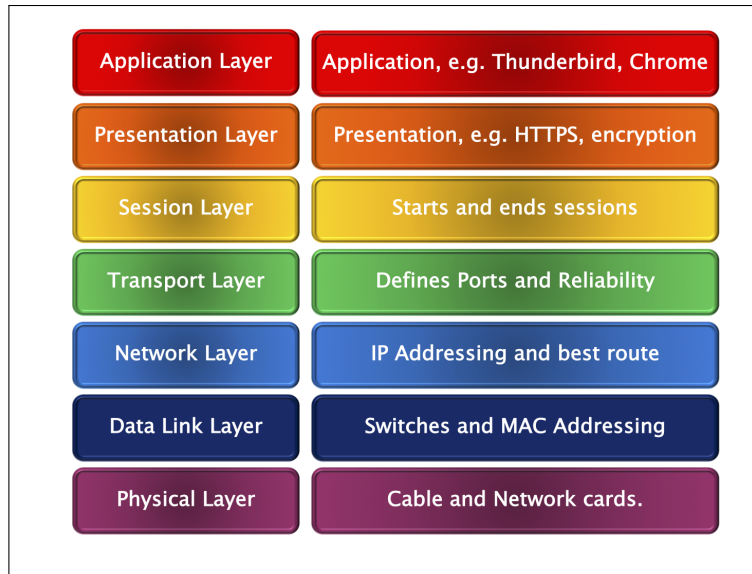


Figure 2: The Open Systems Interconnection (OSI) model

2. (a) A student group has decided to create a Local Area Network (LAN) using the machines available in their computer lab. The network will be used to allow the students to send and receive chat messages, images and videos on a messaging application. There are 10 students (and therefore 10 lab machines) in total. Each lab machine has identical technical specifications. (9 marks)
- In designing the network topology, the student group has come up with two alternatives: a *ring topology* or a *star topology*. Outline the benefits and drawbacks of each topology, in the context of the students' desired use case. Give a recommendation for which topology should be used.
- (b) Figure 2 shows the different layers of the OSI model. Discuss, in your own words, why we use the OSI model. What benefits does it bring us? (12 marks)
- (c) A commercial bank currently shares sensitive documents with customers by emailing them an encrypted copy of the documents, secured using a passphrase. A recent security audit has highlighted this practice as potentially insecure. A security consultant has proposed public private key cryptography as a more suitable solution. (12 marks)
- Explain, in your own words, how public private key cryptography is different from password-based encryption; and how public private key cryptography could improve the bank's security in this situation.

3. (a) *The definition of an 'operating system' is bound to evolve with customer demands and technological possibilities* (Virginia Postrel, Writer and Journalist)
- i. Using an operating system of your choice as an example, describe, in your own words, how operating systems have evolved over the years to meet the changing demands of technology (6 marks)
 - ii. What impact do you see the “changing demands of technology” having on operating systems in coming years? What new features do you think future versions of operating systems will have? (6 marks)
- (b) Explain the concept of *deadlock* in your own words. Give an example of how Deadlock can occur. What role does the Operating System play in helping to avoid problems of deadlock (9 marks)
- (c) Write a script which performs the following tasks (12 marks)
- 1. Writes a list of all files in the current directory to a file called **backup.log** in the user's home directory
 - 2. Makes **backup.log** read-only
 - 3. Makes a directory called *archive* in the user's home directory (only if it doesn't already exist)
 - 4. Moves all files in the current directory to the archive directory
 - 5. grants ownership of the archive directory to the *root* user and *root* group
- N.B.* please type the script directly into your answer document. Do not attach a screenshot or image of your code.