COMP 2432 Operating Systems

Final Examination Revision

1. **[2]** Distinguish between synchronous and asynchronous I/O processing using a diagram.

2. **[2]** What is an interrupt? What are the two types of interrupts? Explain with a diagram how an interrupt could "interrupt" another interrupt. What are the purposes of a timer interrupt?

3. **[2]** What are the supervisor mode and user mode and what is the use of the mode bit? What types of instructions should be executed in supervisor mode? What is a system call? Draw a diagram to illustrate how a system call is implemented. What are the typical types of system calls? What are the common types of system programs?

4. **[2]** What are the common types of OS? Draw diagrams to illustrate the difference between a simple OS and a layered OS. What are the advantages and disadvantages of micro-kernel systems? What are the advantages of Unix and Linux?

5. **[3]** Distinguish between local and environment variables. What is the difference between quote and backquote in the bash shell? Write a bash script program to do ***abc***. What would the following bash script program ***xyz*** produce?

6. **[4]** What is a process? What is a PCB? What is a process state and what are the common process states? How could processes transit between states? What is the relationship between the life cycle of a process and the queues used in the OS?

7. **[4]** What are the three main types of schedulers in an OS? What are their functions? What is context switching?

8. **[4]** How can you create a child process? What is the possible relationship between a child and a parent? What is a process hierarchy? Distinguish between zombie and orphan processes.

9. **[4]** What are the advantages of using a pair of cooperating processes? Give a common application with cooperating processes.

10. **[5]** Distinguish between direct and indirect communication in message passing. What are the common issues in message passing?

11. **[5]** What are the key issues in buffering and synchronization between message sender and receiver?

12. **[6]** Distinguish between non-preemptive and preemptive scheduling algorithms. What are the common performance criteria to be considered in scheduling?

13. **[6]** Explain the operation of common scheduling algorithms. What are the relative performances of the algorithms? Explain the possible problems with a scheduling algorithm, e.g. convoy effect, starvation, excessive context switching.

14. **[6]** What are some common queues in a multi-level queue scheduling algorithm? What are the key parameters in the feedback mechanism of multi-level feedback queue algorithm?

15. **[6]** Draw Gantt charts for the following set of processes using different scheduling algorithms and compute the required performance metrics.

16. **[7]** What are the three types of address binding? Distinguish between logical and physical addresses. Use a diagram to explain how the MMU can translate the logical address and how the invalid address can be detected.

17. **[7]** What are MFT and MVT in contiguous memory allocation? What are some common algorithms in contiguous allocation? How are the following requests served with MFT and with different algorithms in MVT? Explain the concepts of fragmentation and compaction.

18. **[7]** Draw diagrams to show how memory allocation is done for paging and for segmentation. Draw diagrams to illustrate the hardware needed to support paging and segmentation.

19. **[7]** Given a specific system configuration (e.g. size of physical and logical address space and paige size), determine the number of bits of addresses and the division of the addresses into different parts (page/segment number and offset). Show how a given list of logical addresses are translated into physical addresses.

20. **[8]** What is virtual memory? Given the size of physical and virtual address space and page size etc, determine the number of bits to the addresses and address component. Show how a virtual address is mapped to a physical address via the page table.

21. **[8]** Distinguish between demand paging and anticipatory paging. Calculate the effective memory access time for a system.

22. **[8]** Describe the procedures to serve a page fault. Draw a diagram to illustrate how virtual pages can be mapped to physical frames according to the page table.

23. **[8]** Why is there a need for page replacement? Given a reference string, indicate the content of the frames after each page indicated by the reference string is accessed, when different page replacement algorithms are applied, showing also the page faults.

24. **[9]** Distinguish between deadlock and livelock using an example. What are the four necessary conditions to deadlock? What are the four types of methods to handle deadlock?

25. **[9]** Are the following system states safe? Using Banker's algorithm, determine whether a certain resource request by a process can be granted.

26. **[9]** Which of the following system states is/are suffering from deadlock? Explain how the deadlock, if any, could be handled or resolved.

27. **[10]** Explain what a critical section is. What are the three properties that a solution to a critical section problem should satisfy?

28. **[10]** Give a solution to the producer/consumer problem using (*a*) shared variables, (*b*) critical sections.

29. **[10]** Determine whether the following program is correct in a solution to the critical section problem. Explain your answer via examples.

30. **[10]** Define the two operations on a semaphore. Explain how the semaphore operations could be implemented. Show how semaphores can be used to solve the critical section problem.

31. **[11]** List the attributes for a file. Give the common operations on a file. Explain briefly the access modes to a file. Give the common operations on a directory. Differentiate between NFS, NAS and Cloud storage to support file systems.

32. **[11]** Differentiate between protection and security. How does policy differ from mechanism? What are domains and objects? How are they stored in the access matrix? Explain briefly the three implementations of the access matrix.

1. **[lab]** What does the following program fragment output?

2. **[lab]** Write a program fragment to do ***abc***.

3. **[lab]** Modify the following program fragment in order to achieve ***xyz***.

4. **[lab]** The following program contains some bugs for ***pqr***. Identify them and correct them.