

ALCCS – (OLD SCHEME)

Code: CS31
Time: 3 Hours

MARCH 2011

Subject: OPERATING SYSTEMS
Max. Marks: 100

NOTE:

- Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.
- Parts of a question should be answered at the same place.

Q.1

(7 × 4)

- Explain the main functions of a kernel and its relationship with the operating system.
- Define a process. Differentiate between user and kernel process.
- What is the purpose of Inter Process Communication?
- Assume a single CPU system with 5 processes in the ready queue. Suppose time quantum is 10 milliseconds. What is the maximum waiting time for a process to get the CPU in the RR scheduling?
- Explain the purpose of dynamic relocation.
- Consider a two-level paging system with first level of 8 bits and second level of 12 bits. If the address space uses 32 bit, what is the size of the page and how many pages are there in the logical address space?
- Differentiate between security and protection.

Q.2

- Compare and contrast
 - Preemption and Interruption
 - Microkernel and Monolithic Kernel
 - Single-threaded Kernel vs. Multithreaded kernel**(12)**
- Explain the advantages and disadvantages of programmed I/O and Interrupt-driven I/O. **(6)**

Q.3

- Is it easier to write concurrent programs for a uniprocessor system than writing concurrent programs for a multiprocessor system? Justify your answer. **(4)**
- Differentiate between
 - Authorization and Authentication
 - Virus and Worm**(6)**
- In a segmentation-based system, the main memory has the following holes in this order: 21K, 5K, 90K, 54K, 10K, 25K, and 56K; there are three new requests for memory of sizes 10K, 7K, and 22K. The system does first-come first serve service.

Explain what holes will be taken for each of First Fit and Best Fit memory allocation schemes. (8)

Q.4 a. A demand paging system on a 32-bit machine with 20-bit address bus has a page size of 4KB. A process is allocated the first and the last 64MB of its address space of size 2^{32} . How much memory does the system use to hold page tables if (a) the system has one level paging, (b) two-level paging with 10 bit per level. (10)

b. What is a remote procedure call? How is it different from a local procedure call? (8)

Q.5 a. A hard-disk drive reads “120 GB HDD 7200 rpm 3 GB/sec transfer rate”. If the drive has a sector size of 512 bytes, what is the average rotational latency and transfer time to read one disk sector? (6)

b. Differentiate between:

(i) fork and exec system call

(ii) Distributed operating system and a Network operating system

(iii) Internal and External Fragmentation (12)

Q.6 a. Suppose we have a processor with a hardware cache memory. Suppose a program is run by the CPU and this produces 500,000 memory references, out of which 475,000 hits the cache memory. Suppose average memory access time is 70 ns and cache access time 20 ns, of which 10 ns are for lookup. Suppose the system follows the write-through policy. (a) What is the hit ratio? (b) What is the average memory reference time as seen by the CPU if, (i) all the memory references are read, (ii) 80% of the memory references are read, and (iii) 90% of the memory references are read? (4×2)

b. Consider the following resource-allocation state involving five processes and five resources. Total[j] specifies the total number of instances of resource j (including both allocated and free instances). Alloc[i, j] denotes the number of instances of resource j currently allocated to process i. Req[i, j] denotes the number of instances of resource j that process i is currently requesting. Determine which processes (if any) are deadlocked.

Total = [11, 10, 6, 9, 6]

Alloc = [[1, 0, 2, 4, 1], [0, 1, 0, 2, 3], [0, 0, 1, 0, 0], [0, 1, 0, 1, 0], [1, 0, 0, 1, 2]]

Req = [[1, 5, 4, 2, 2], [1, 0, 0, 7, 2], [8, 8, 2, 0, 0], [6, 6, 6, 6, 6], [7, 3, 0, 1, 0]] (10)

Q.7 a. What are Lamport’s logical clock and how is it used in totally ordering events in a distributed computation. (7)

b. What is an operating system and why do we need it? Describe any two main functions of operating systems. (4)

c. What is Belady’s anomaly and explain whether optimal replacement algorithm exhibit Belady’s anomaly. (7)