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Time taken 1 hour 29 mins

Grade 70.00 out of 100.00

Question 1

Incorrect

Mark 0.00 out of 3.00

The physical address space is at least as large as the virtual address space

Select one:

- ☒ True 
- ☐ False

The correct answer is 'False'.


Question 2

Correct

Mark 5.00 out of 5.00

Consider a disk that has 10 data blocks starting from block 14 through 23. Let there be 2 files on the disk: f1 and f2. The directory structure lists that the first data blocks of f1 and f2 are respectively 22 and 16. Given the FAT table entries as below, what are the data blocks allotted to f1 and f2? (14,18); (15,17); (16,23); (17,21); (18,20); (19,15); (20, -1); (21, -1); (22,19); (23,14). (x, y) indicates that the value stored in table entry x points to data block y.

Select one:

- ☒ a. f1= 22,19,15,17,21; f2= 16,23,14,18,20 
- ☐ b. f1= 22,19,14,18,20; f2= 16,23,17,15,21
- ☐ c. f1= 22,23,14,15,17; f2= 16,18,19,20,21

The correct answer is: f1= 22,19,15,17,21; f2= 16,23,14,18,20

Question 3

Correct

Mark 6.00 out of 6.00

Assume within an i-node there are 12 direct pointers, a single-indirect pointer, and a double-indirect pointer. Assume a 4KB blocksize, and disk addresses that are 32 bits.

What is the maximum file size (measured in number of blocks) on this Unix system?

Select one:

- ☒ a. 1049612 blocks
- ☐ b. none of them
- ☐ c. 67117068 blocks
- ☐ d. 262668 blocks



The correct answer is: 1049612 blocks

Question 4

Incorrect

Mark 0.00 out of 3.00

File allocation table is the mechanism through which Unix like OS's allocate disk blocks to files

Select one:

- ☒ True ✖
- ☐ False

The correct answer is 'False'.

Question 5

Incorrect

Mark 0.00 out of 3.00

Consider the following situation where a system has 12 resources allocated among processes P_0 , P_1 , and P_2 as follow

	Max	Allocated	Need
P_0	10	5	5
P_1	4	2	2
P_2	9	3	6

It is possible for these 3 processes to complete their execution without entering a deadlock state.

Select one:

- ☐ True
- ☒ False ✖

The correct answer is 'True'.

Question 6

Incorrect

Mark 0.00 out of 6.00

Mutex lock is a synchronization primitive provided by the OS where the "acquire()" and "release()" functions are implemented using a hardware synchronization primitive such as test-&-set(). Two mutexes M_1 and M_2 initialized to 0 are defined in a same process P_1 , what could happen if two different threads execute $\text{acquire}(M_1)$ and $\text{acquire}(M_2)$ almost in same time?

Select one:

- ☒ a. This is really unfortunate, since both $\text{acquire}(M_1)$ and $\text{acquire}(M_2)$ rely on the same test-&-set() primitive, one will succeed and the other will fail even though both mutexes are available ✖
- ☐ b. If another process P_2 has a mutex with the same name (for example M_2), then M_2 will not be available anyway if a thread of P_2 executes $\text{acquire}(M_2)$ before P_1
- ☐ c. test-&-set() is atomic, thus cannot be de-scheduled, the calls to test-&-set() will be serialized, each thread will be successful getting its mutex

The correct answer is: test-&-set() is atomic, thus cannot be de-scheduled, the calls to test-&-set() will be serialized, each thread will be successful getting its mutex

Question 7

Correct

Mark 6.00 out of 6.00

Given 3 binary semaphores L_1 , L_2 , L_3 , initially in state 0 (unlocked), and the code below

```

thread1();
    wait( $L_1$ );
    wait( $L_2$ );
    critical section...
    signal( $L_2$ );
    signal( $L_1$ );
thread2();
    wait( $L_3$ );
    wait( $L_1$ );
    critical section...
    signal( $L_1$ );
    signal( $L_3$ );
thread3();
    wait( $L_2$ );
    wait( $L_3$ );
    critical section...
    signal( $L_3$ );
    signal( $L_2$ );

```

Which of the following statements is correct assuming a round robin scheduling of the 3 threads (Recall: round robin is preemptive)

Select one:

- ☒ a. This code will deadlock if Thread1, Thread2 and Thread3 are scheduled in this order, where in the first round Thread1 context switch after $\text{wait}(L_1)$, Thread2 context switch after $\text{wait}(L_3)$ and Thread3 context switch after $\text{wait}(L_2)$ ✔
- ☐ b. This code will always deadlock if Thread1, Thread3 and Thread2 are scheduled in this order
- ☐ c. This code will never deadlock
- ☐ d. This code will deadlock if Thread1, Thread2 and Thread3 are scheduled in this order, where in the first round Thread1 context switch after $\text{wait}(L_2)$, Thread2 context switch after $\text{wait}(L_3)$.

The correct answer is: This code will deadlock if Thread1, Thread2 and Thread3 are scheduled in this order, where in the first round Thread1 context switch after $\text{wait}(L_1)$, Thread2 context switch after $\text{wait}(L_3)$ and Thread3 context switch after $\text{wait}(L_2)$

Question 8

Correct

Mark 3.00 out of 3.00

A nonpreemptive kernel requires mechanisms such as mutex locks to prevent race conditions when accessing shared kernel data structures.

Select one:

- ☐ True
- ☒ False ✓

The correct answer is 'False'.

Question 9

Correct

Mark 5.00 out of 5.00

Assume that you have a page-reference string for a process with k frames (initially all empty). The page-reference string has length n in which m distinct page numbers occur in it. Given any page-replacement algorithms, what is an upper bound on the number of page faults?

Select one:

- ☐ a. m
- ☐ b. k
- ☒ c. n ✓

The correct answer is: n

Question 10

Incorrect

Mark 0.00 out of 3.00

"Swapping" is the term used to describe the situation where a process spends more time paging than executing.

Select one:

- ☒ True ✗
- ☐ False

The correct answer is 'False'.

Question 11

Correct

Mark 5.00 out of 5.00

The name of the page replacement algorithm which replaces the page that will not be used for the longest period of time is

Select one:

- ☐ a. Least recently used
- ☐ b. First-in-first-out
- ☒ c. Optimal page replacement
- ☐ d. Copy-on-write
- ☐ e. Approximation page replacement



The correct answer is: Optimal page replacement

Question 12

Correct

Mark 3.00 out of 3.00

Disk blocks are made up of one or more sectors

Select one:

- ☒ True
- ☐ False

The correct answer is 'True'.

Question 13

Correct

Mark 5.00 out of 5.00

Assume that you have a page-reference string for a process with k frames (initially all empty). The page-reference string has length n in which m distinct page numbers occur in it. Given any page-replacement algorithms, what is a lower bound on the number of page faults?

Select one:

- ☒ a. m
- ☐ b. k
- ☐ c. n



The correct answer is: m

Question 14

Correct

Mark 3.00 out of 3.00

Mutual exclusion prevents simultaneous access to a shared resource

Select one:

- ☒ True ✓
- ☐ False

The correct answer is 'True'.

Question 15

Incorrect

Mark 0.00 out of 6.00

Mutex locks are spinlock (busy waiting) synchronization primitives. What will happen if a thread T_1 context switch while executing a critical section protected by a mutex lock L_0 ?

Select one:

- ☐ a. Context switch within a critical section is against mutual exclusion, it allows threads to re-enter a critical section without requesting a lock
- ☐ b. Nothing special will happen, T_1 will resume executing the code in its critical section once it is re-scheduled
- ☒ c. The system can potentially deadlock. Because a mutex is a spinlock, if a second thread T_2 seeks to acquire the mutex lock L_0 , T_2 will monopolize the CPU, T_1 will never return into its critical section and will never release the lock L_0 , deadlock ✗

The correct answer is: Nothing special will happen, T_1 will resume executing the code in its critical section once it is re-scheduled

Question 16

Correct

Mark 6.00 out of 6.00

Consider a FAT-16 file system. A user wants to install a disk with 131072 512-byte sectors. What is the potential problem?

Select one:

- ☐ a. The FAT will not be fully utilized as the number of entries is larger than the number of blocks (sectors)
- ☐ b. The capacity of the disk is just fine for this file system
- ☒ c. The disk will not be fully utilized as the number of entries in the FAT is smaller than the disk capacity ✓

The correct answer is: The disk will not be fully utilized as the number of entries in the FAT is smaller than the disk capacity

Question 17

Correct

Mark 4.00 out of 4.00

Consider the following situation where a system has 12 resources allocated among processes P_0 , P_1 , and P_2 as follow

	Max	Allocated	Need
P_0	9	5	4
P_1	4	2	2
P_2	9	3	6

This system is in safe state

Select one:

- ☒ True ✓
- ☐ False

The correct answer is 'True'.

Question 18

Correct

Mark 4.00 out of 4.00

When there is only one resource, processes cannot deadlock as the conditions of hold and wait and circular waiting are eliminated.

Select one:

- ☒ True ✓
- ☐ False

The correct answer is 'True'.

Question 19

Incorrect

Mark 0.00 out of 6.00

Assume only the address of the data block for root directory (not the i-node of root directory) is cached in main memory. All other contents stored in the File System are not cached.

Assume the content of directories can be stored in only one data block.

How many disk accesses are required to read the first byte of the file: /1/2/mydoc.txt?

Select one:

- ☐ a. 6
- ☒ b. 8
- ☐ c. none of them
- ☐ d. 7

✗

The correct answer is: 7

Question 20

Correct

Mark 4.00 out of 4.00

If main memory crashes, the recent updates to the bit map of free blocks will be lost because this bit map is in main memory

Select one:

- ☐ True
- ☒ False ✓

The correct answer is 'False'.

Question 21

Correct

Mark 3.00 out of 3.00

Counting semaphores can allow more than one thread at any given time to access the critical section

Select one:

- ☒ True ✓
- ☐ False

The correct answer is 'True'.

Question 22

Correct

Mark 5.00 out of 5.00

What "copy-on-write" means?

Select one:

- ☐ a. Copy the page table on a fork
- ☐ b. Swap a page from backstore into main memory when a reference is made to it by the process
- ☒ c. Copy a logical page into a new frame when a child or the parent execute a write ✓
- ☐ d. Copy a file once it is written

The correct answer is: Copy a logical page into a new frame when a child or the parent execute a write

Question 23

Correct

Mark 3.00 out of 3.00

Inodes is an example of linked allocation of disk blocks to files

Select one:

- ☐ True
- ☒ False ✓

The correct answer is 'False'.

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