Final Exam - Fall 2020

Due 18 Dec at 12:10 **Points** 60 **Questions** 60
Available 18 Dec at 10:00 - 18 Dec at 12:10 about 2 hours **Time limit** 100 Minutes

Instructions

There are 60 questions (24 from CLO1, 18 from CLO2 and 18 from CLO3) in this exam.

The total duration of the final exam is 1.5 hours = 90 minutes.

Please remember that there is no back button so once you have answered a question, you cannot go back.

You are required to do this on your own without consultation with anyone else.

Good luck.

Attempt history

	Attempt	Time	Score
LATEST	Attempt 1	66 minutes	57 out of 60

ⓘ Correct answers are hidden.

Score for this quiz: **57** out of 60
Submitted 18 Dec at 11:16
This attempt took 66 minutes.

Question 1 — 1 / 1 pts

Translation Look-aside Buffers (TLBs) store:

- ○ Page tables
- ○ interrupt handlers
- ◉ Recently used entries of page tables

- Data of the running process

Question 2

1 / 1 pts

Which of the following scheduling policies is more suitable for interactive systems:

- Shortest Job First
- Shortest Time to Completion First
- First In First Out
- Round Robin

Question 3

1 / 1 pts

Priority boost in the multi-level feedback queue (MLFQ) policy serves to:

- improve the performance of I/O intensive jobs
- prioritize the newly arrived jobs
- prevent starvation of long CPU intensive jobs
- boost the priority of smaller jobs

Question 4

1 / 1 pts

The following data is given to you.

- Total CPU cores: 4
- Time slice: 1 msec
- Total processes: 4
- Each process takes 2 msecs to finish.

Assuming that the processes can be multithreaded, what is the least amount of time that the 4 processes can take to finish execution completely (ignoring the context switch time and assuming no I/O)?

- 1 msecs
- 8 msecs
- (selected) 2 msecs
- 4 msecs

Question 5

1 / 1 pts

Which of the following techniques does not suffer from *internal* fragmentation?

- Paging
- (selected) Segmentation
- the buddy allocator
- Allocating one chunk of RAM for the whole address space of a process

Question 6

1 / 1 pts

The disadvantage of multi-queue multiprocessor scheduling (MQMS) compared to single-queue multiprocessor scheduling (SQMS) is:

- (●) has trouble due to load imbalance
- ( ) it doesn't handle cache affinity well
- ( ) it doesn't scale better
- ( ) it is simpler to implement

Question 7

1 / 1 pts

A process in running state may go into ready state when one of the following happens:

- (●) An interrupt is raised.
- ( ) A new process is admitted
- ( ) An event happens for e.g. an I/O event
- ( ) none of these other options is correct

Question 8

1 / 1 pts

In *free space management*, the *coalescing* operation can only be performed on those members of the free list which are next to each other:

- ( ) in the programmer's mind

- in the free list
- in the address space
- in the linked list as well as in the address space

Incorrect

Question 9

0 / 1 pts

Paging without *page tables*

- will have external fragmentation
- will make program execution extremely slow
- is exactly the same as segmentation
- cannot implement virtual memory

Question 10

1 / 1 pts

The following data is given to you.

- Total CPU cores: 1
- Time slice: 1 msec
- Total processes: 4
- Each process takes 2 msecs to finish.

Assuming that the processes can be multithreaded, what is the most amount of time that the 4 processes can take to finish execution completely (ignoring the context switch time and assuming no I/O)?

- 2 msecs

1 msecs

4 msecs

8 msecs

Question 11

1 / 1 pts

The following data is given to you.

- Total CPU cores: 4
- Time slice: 1 msec
- Total processes: 4 (P1, P2, P3, P4)
- Each process takes 2 msecs to finish.
- P2 can start only after P1 finishes execution
- P4 can start only after P3 finishes execution

Assuming that the processes can be multithreaded, what is the least amount of time that the 4 processes can take to finish execution completely (ignoring the context switch time and assuming no I/O)?

4 msecs

1 msecs

2 msecs

8 msecs

Question 12

1 / 1 pts

There are two processes: P1 and P2. P1 runs for 4 msecs and P2 runs for 2 msecs. Arrival time of P1 is 0 msecs while the arrival time of P2 is 2 msecs. Assuming a time slice value of 1 msecs, what will be the average turn around time using round robin scheduling with pre-

emption. At time 2 msecs when P2 arrives the Scheduler has a choice of scheduling P1 or P2; assume it schedules P2 first.

- Cannot be determined as insufficient data given.
- Avg. turnaround time: 3.5 msecs
- Avg. turnaround time: 2.5 msecs
- Avg. turnaround time: 4.5 msecs

Question 13

1 / 1 pts

What do you understand from process starvation when MLFQ scheduling is used?

- A process which requires memory but is unable to get it and hence starve.
- A process which does not finish within its stipulated time slice is demoted starting from the top most queue all the way to the lowest priority queue. This makes this process unable to execute and hence starve for CPU.
- None of the given options.
- A process which want to acquire an I/O device but it is unable to do so.

Question 14

1 / 1 pts

What is the use of the wait(NULL) call if it is given in the context/scope of the parent process?

- [x] It ensures that the parent process waits until the child process finishes.
- [ ] It ensures that the child process waits until the parent process finishes.
- [ ] It ensures that the parent process may finish execution immediately.
- [ ] It ensures that both child and parent may finish together.

Question 15

1 / 1 pts

Which of the following is *not* an example of *fair share scheduling*:

- [ ] Lottery scheduling
- [ ] Completely Fair Scheduler
- [ ] Stride scheduling
- [x] Multi-Level Feedback Queue

Question 16

1 / 1 pts

The operating system provides abstraction of memory through virtualization of memory. What do you understand from virtualization of memory?

It means providing access to memory locations through logical addresses which are later mapped to a physical address through address translation.

It means providing access to volatile memory.

It means providing access to memory in a highly optimized way

It means providing access to non-volatile memory.

Question 17

1 / 1 pts

What will be response time of a process with an arrival time of 20msecs and a first run time of 10msecs?

-10 msecs

10 msecs

0 msecs

This is impossible as the first run time must always be greater than or equal to the arrival time.

Question 18

1 / 1 pts

Once a program terminates, any memory that has not been free'd will result in memory leaks.

True

False

Question 19

1 / 1 pts

The operating system provides virtualization of CPU. What does this mean?

It means mapping each program to a process. Then each process is provided access to a virtual CPU which is later mapped to a physical CPU.

It means allowing a single program to access multiple CPUs.

It means giving each program access to physical CPU directly without abstraction indefinitely.

It means allowing one program to always run on the same CPU core.

Question 20

1 / 1 pts

```
#include <stdio.h>
int main() {
  for (int i=0; i<3; i++)
     fork();

  printf ("hello\n");
}
```

How many times will the above program print the string "hello"?

- 1
- 8
- 2
- 4

Question 21

1 / 1 pts

The fork() call differs from the exec() call because (choose all that apply)

- [ ] exec creates a new process which is an exact replica of the currently running program
- [x] exec does not create a new process but it modifies the currently running process into a different program.
- [x] fork creates a new process which is an exact replica of the currently running program
- [ ] fork does not create a new process but it modifies the currently running process into a different program.

Question 22

1 / 1 pts

Single queue multiprocessor scheduling (SQMS) is not scalable because (pick the best answer)

- Requires extra overhead to manage I/O.
- Requires extra overhead of managing memory.
- Needs locking to be implemented for synchronized access to the single shared queue between multiple CPUs.
- None of these other options is correct

Question 23

1 / 1 pts

In *free space management*, the *magic number* is used to:

- optimize the free space management
- verify the integrity of the pointer being passed to the function free()
- store the size of the allocated block
- store the pointer returned by the function malloc()

Question 24

1 / 1 pts

The *cooperating approach* of sharing CPU among multiple processes would use the

- timer interrupt
- yield() system call
- interrupt handlers
- atomic instructions

Question 25

1 / 1 pts

If atomicity is violated, what problems may arise in a multi-threaded program. (choose all that apply)

- [ ] mutual exclusion
- [x] no mutual exclusion
- [x] non-deadlock bugs
- [ ] deadlock bugs

Incorrect

Question 26

0 / 1 pts

Assume, in a multi-threaded program, the main thread initializes a semaphore with a value of -1, creates other threads, and then calls *sem_wait()* on this semaphore. This thread will sleep until

- the end of times
- when sem_post() is called once on this same semaphore
- one of the child threads calls thread_exit()

- when sem_post() is called twice on this same semaphore

Question 27

1 / 1 pts

Mutual exclusion helps us avoid

- Concurrency
- Deadlocks
- Race conditions
- Memory leaks

Question 28

1 / 1 pts

In the *producer-consumer* problem

- a producer waits when the buffer is not full
- the producer waits when the buffer is empty
- the consumer waits when the buffer is full
- a consumer waits when the buffer is empty

Question 29

1 / 1 pts

Semaphores can mimic the behaviour of

- (●) both locks and condition variables
- ( ) neither locks nor condition variables
- ( ) condition variables only
- ( ) locks only

Question 30

1 / 1 pts

Having multiple threads in a program is useful in

- ( ) neither single-core nor in multi-core CPU environments
- ( ) only a multi-core CPU environment
- ( ) only a single-core CPU environment
- (●) both single core as well as multi-core CPU environments

Question 31

1 / 1 pts

Why are locks used when a shared resource is accessed? (choose all that apply)

- [ ] locks improve I/O performance.
- [ ] locks prevent data over and under flow
- [x] locks prevent race conditions.

- [ ] locks protect data from viruses.

- [x] locks provide mutual exclusion that is only one thread can access a shared resource.

Question 32

1 / 1 pts

Threads can share address space which allows

- (•) multiple tasks to be performed simultaneously while sharing resources (code, data, and other resources).

- ( ) each thread to do separate I/O request.

- ( ) each thread to execute on a different CPU core.

- ( ) none of these other options is correct

Question 33

1 / 1 pts

Why is it important to provide a thread join call after the thread has been created?

- (•) It allows the main thread to wait until the child thread we are creating finishes execution.

- ( ) It allows the main thread to perform I/O.

It allows the child thread to perform I/O.

It allows the child thread to wait until the main thread finishes execution.

Question 34

1 / 1 pts

Which of the following conditions should happen for a deadlock to occur?

Hold and wait

All of these other options

Mutual exclusion

Circular wait

Question 35

1 / 1 pts

Why is it so that we can return address of a variable allocated dynamically through malloc from a thread function but we cannot return address of a variable allocated on stack? (choose all that apply)

each thread has its own heap memory so once a thread function finishes execution, its heap memory is reclaimed.

each thread has its own stack so once a thread function finishes execution, its stack memory is reclaimed.

- [x] all threads of a process share the same heap memory hence a variable allocated dynamically (through malloc) remains visible to all other threads.

- [ ] all threads of a process share the same stack so once a thread function finishes execution, its stack memory remains visible to all other threads.

Question 36

1 / 1 pts

Which of the following might happen if multiple threads try to access the same shared resource (choose all that apply)

- [x] race condition
- [ ] everything works as normal nothing needs to be done.
- [ ] the shared resource remains with only one thread and all other threads cannot access the shared resource in their life time.
- [x] data may become inconsistent

Question 37

1 / 1 pts

The pthread_join function is declared as follows:

```
int pthread_join(pthread_t thread, void** value_ptr);
```

What is the use of the second parameter value_ptr?

- (●) It is used to return values from the thread function.
- ( ) It is used to capture error codes.
- ( ) None of the options given are correct.
- ( ) It is used to pass a value to the thread function.

Question 38

1 / 1 pts

When using multiple locks between threads, there is a good probability of entering into a *deadlock* if we are not careful. Which of the following *does not* help in preventing or resolving deadlocks?

- ( ) All the threads should follow the same order when acquiring locks
- (●) Always use an odd number of locks in your program
- ( ) all of these other options
- ( ) After waiting for a certain amount of time for a lock, a thread should abandon waiting and release all the locks that it already holds

Question 39

1 / 1 pts

What does the fairness property of locks ensure?

- ( ) It ensures that all threads get a chance to perform memory transactions.

It ensures that all thread get a chance to perform I/O.

It ensures that all threads get a chance to acquire the lock

It ensures that all threads get a chance to terminate when they wish..

Question 40

1 / 1 pts

In the reader-writer locking scheme, if we are given information about a reader thread (R1) that it is currently in its critical section. From this information, which of the following statements can we deduce about the other threads:

There is no other thread in its critical section at this moment

There is no other writer thread in its critical section at this moment

There is no other reader thread in its critical section at this moment

All of these other options are correct

Question 41

1 / 1 pts

Condition variables prevent _____ which is unavoidable when locks or mutex are used. (choose all that apply). Assuming the lock/mutex implementation does not allow the waiting threads to sleep.

mutual exclusion

spin wait or busy waiting

- [ ] encryption
- [x] wasting of CPU cycles

Question 42

1 / 1 pts

In a multi-threaded program sharing global variables between threads, race conditions can occur in

- [ ] neither single-core nor in multi-core CPU environments
- [ ] only a single-core CPU environment
- [ ] only a multi-core CPU environment
- [x] both single core as well as multi-core CPU environments

Question 43

1 / 1 pts

The purpose of the DMA is to

- [ ] help the CPU execute instructions atomically
- [ ] help the processor do efficient scheduling
- [ ] increase the CPU clock frequency
- [x] liberate the CPU from doing data transfers to and from the I/O device

Question 44

1 / 1 pts

In communicating with slow-speed I/O device we'd prefer using which of the following two techniques:

- polling
- interrupts

Question 45

1 / 1 pts

Which block is used when the file system is mounted?

- inode block
- data block
- super block
- file descriptor block

Question 46

1 / 1 pts

Why is track skew given in hard disk drives (HDDs)?

- It helps provide additional storage.
- It provides data security.

It helps in transferring of head when data across track boundaries is involved.

It maintains data integrity.

Question 47

1 / 1 pts

What is the significance of the inode data structure?

It stores file descriptors of all files in the current directory.

it contains information about all aspect of file which helps in reading/writing of data on file as well as provides access to all properties of a file or directory.

It stores data associated with a file.

It stores file descriptors of all directories in the current directory.

Question 48

1 / 1 pts

Why can't hard links be created on directories?

Directories can create hard links to other directories.

Directories can create hard links to other directories on a different partition.

Directories might create links to themselves creating dependency cycles which would be difficult to deal with.

Directories have special characteristics which are not supported by hard links.

Question 49

1 / 1 pts

What is the role of DMA (Direct Memory Access) during I/O?

offload I/O from CPU so that CPU has no involvement in data movement.

Improve accuracy of I/O

Provide buffering support for I/O

Provide encryption to data during I/O

Question 50

1 / 1 pts

In the Very Simple File System (VSFS) discussed in the book, which of the following operations may access the inode bitmap?

writing to an opened file

creating a new file

- reading from an opened file
- opening an existing file

Question 51

1 / 1 pts

In the Very Simple File System (VSFS) discussed in the book, which of the following operations may access the data bitmap?

- writing to an opened file
- creating a new file
- opening an existing file
- reading from an opened file

Question 52

1 / 1 pts

What is the use of the file descriptor that is returned or given to most file system API functions?

- It helps identify the file uniquely with in the same process
- Its a redundant number which is not useful.
- It stores information about the file like file size.
- It stores information about the file format.

Question 53

1 / 1 pts

In the Very Simple File System (VSFS) discussed in the book, which of the following operations may modify the *inode table*?

- (●) all of these options
- ( ) reading from an opened file
- ( ) opening an existing file
- ( ) writing to an opened file

Question 54

1 / 1 pts

In disk scheduling, the Shortest Seek Time First (SSTF) algorithm had a flaw, eventually corrected in the SCAN algorithm, that the

- ( ) small jobs risked starvation
- ( ) newly arrived jobs risked starvation
- (●) jobs accessing a far away track risked starvation
- ( ) jobs accessing a nearby track risked starvation

Question 55

1 / 1 pts

Why can't hard links be created on directories?

Directories have special characteristics which are not supported by hard links.

Directories might create links to themselves creating dependency cycles which would be difficult to deal with.

Directories can create hard links to other directories.

Directories can create hard links to other directories on a different partition.

Incorrect

Question 56

0 / 1 pts

In the Very Simple File System (VSFS) discussed in the book, which of the following operations may modify a data block?

all of these other options

deleting a file

writing to an opened file

creating a new file

Question 57

1 / 1 pts

Why is polling bad?

- [x] because it repeatedly accesses the I/O device.
- [ ] because it hinders operating system execution.
- [ ] none of these other options is correct
- [x] because it wastes CPU cycles as CPU is not doing any useful work.

Question 58

1 / 1 pts

Assuming the following permission bits information, what is the access level for owner.

```
-r--r--r--
```

- (•) read only
- ( ) None of the options.
- ( ) read/write
- ( ) read/write/execute

Question 59

1 / 1 pts

Assuming the following permission bits information, what is the access level for group members.

```
-r--rw-rw-
```

- (•) read/write

- read only
- write only
- read/write/execute

Question 60

1 / 1 pts

Assume you have two disks A and B. All other things are equal but:

- the average seek time for A is 10% greater than B

- the max transfer rate for A is 10% greater than B

For a workload which continuously does many small transfers at random locations on hard disk, which of these disks will you prefer?

- A
- B

Quiz score: **57** out of 60