Université d'Ottawa
Faculté de génie

École de science informatique
et de génie électrique

uOttawa

L'Université canadienne
Canada's university

University of Ottawa
Faculty of Engineering

School of Electrical Engineering
and Computer Science

Midterm Exam – CSI3131

Exam Duration: 80 minutes 9 July 2019

Professor: Ayman El Sawah

First Name: ____________________

Last Name: ____________________

Student Number: ____________________

Signature: ____________________

Closed book exam.

Please answer in the space provided (in this questionnaire).
No calculators are allowed.

Note: Points **10x2 + 30x1 = 50**

Once you complete the exam, please exit quietly leaving your booklet at the booth.

(Multiple Choice Questions – Use the Scantron Sheet provided)

Each multiple-choice question has only <u>one correct answer.</u> If you think there is more than one possible answer, <u>select only one answer</u> – otherwise auto-scan is going to fail the question.

Question 1 (1 point) – To access the services of operating system, the interface is provided by:

[✓ a)] System calls
b) API
c) Library
d) Assembly instructions
e) None of the above

Question 2 (1 point) – Which one of the following is **<u>not</u>** true?

a) kernel is the program that constitutes the central core of the operating system
b) kernel is the first part of operating system to load into memory during booting
[✓ c)] kernel is made of various modules which will be loaded on demand
d) kernel remains in the memory during the entire computer session

Question 3 (1 point) – In operating system, each process has its own:

a) address space and global variables
b) open files
c) pending alarms, signals and signal handlers
[✓ d)] all of the above mentioned
e) None of the above mentioned

Question 4 (1 point) – Which system call returns the process identifier of a terminated child?

[✓ a)] wait
b) exit
c) fork
d) get
e) exec

Question 5 (1 point) – The number of processes completed per unit time is known as ___________

a) Response Time
[✓ b)] Throughput
c) Efficiency
d) Turnaround Time
e) None of the above

Question 6 (1 point) – The Process Control Block is:

[✓ a)] Data Structure
b) A secondary storage section
c) A Block in memory
d) All of the above
e) None of the above

Question 7 (1 point) – The degree of multi-programming is:

a) the number of processes executed per unit time
b) the number of processes in the ready queue
c) the number of processes in the I/O queue
[✓ d)] the number of processes in memory
e) None of the above

Question 8 (1 point) – The parent process completes execution, but the child keeps executing, then the child process is known as:

[✓ a)] Orphan
b) Zombie
c) Body
d) Dead
e) None of the above

Question 9 (1 point) – In Java, you can create a thread by:

a) Extending the Object class or using the intrinsic lock
b) Calling fork system call
[✓ c)] Implementing the Runnable interface or extending the Thread class
d) Creating immutable objects out of the Task class
e) Extending the Runnable class or implementing the Thread interface

Question 10 (1 point) – A monitor is a module that encapsulates:

a) shared data structures
b) procedures that operate on shared data structure
c) synchronization between concurrent procedure invocation
[✓ d)] all of the mentioned
e) None of the above

Question 11 (1 point) – What is a medium-term scheduler?

a) It selects which process has to be brought into the ready queue
b) It selects which process has to be executed next and allocates CPU to it
[✓ c)] It selects which process to remove from memory by swapping
d) All of the above
e) None of the mentioned

Question 12 (1 point) – In Round-Robin scheduling, when the time quantum given to a process expires, the process goes from the ____ state to the ____ state:

a) Running, Blocked
b) Ready, Running
c) Ready, Suspended
[✓ d)] Running, Ready
e) Blocked, Ready

Question 13 (1 point) – The interval from the time of submission of a process to the time of completion of a processing burst is termed as: ________

a) waiting time
[✓ b)] turnaround time
c) response time
d) real time
e) time quantum

Question 14 (1 point) – In priority scheduling algorithm, when a process arrives at the ready queue, its priority is compared with the priority of: ______

a) all processes
b) blocked processes
c) parent process
d) child process
[✓ e)] running process

Question 15 (1 point) – Which one of the following cannot be scheduled by the kernel?

a) kernel thread
[✓ b)] user thread
c) process
d) interrupt service routine
e) none of the mentioned

Question 16 (1 point) – An I/O bound program will typically have:

a) few very short CPU bursts
b) many very short I/O bursts
[✓ c)] many very short CPU bursts
d) few very short I/O bursts
e) many very long CPU bursts

Question 17 (1 point) – Bounded waiting implies that there exists a bound on the number of times: a process is allowed to enter its critical section:

[✓ a)] the process is allowed to enter the critical before other processes can make a request to enter the critical section
b) other processes are allowed to enter the critical section before the process can enter the critical section after it made the request to enter the critical section
c) the process is allowed to enter the critical before other processes can enter the critical section
d) the process is allowed to request the critical after other processes enter the critical section

Question 18 (2 point) – Consider the methods used by processes P1 and P2 for accessing their critical sections whenever needed, as given below. The **initial values of shared boolean variables S1 and S2 are randomly assigned**.

//Method used by P1:
while(S1==S2);
Critical section
S1 = S2;
	//Method used by P2:
	while(S1!=S2);
	Critical section
	S2 = not(S1);

In this situation, the following statements describes properties achieved:

a) Mutual exclusion but not progress
b) Progress but not mutual exclusion
c) Neither mutual exclusion nor progress
d) Both mutual exclusion and progress

Question 19 (1 point) – An un-interruptible unit is known as:

a) single
b) atomic
c) static
d) mutex

Question 20 (1 point) – Spinlocks are intended to provide ___________

a) Mutual Exclusion
b) Bounded Waiting
c) Aging
d) Progress

Question 21 (2 point) – The following program consists of 3 concurrent processes and 3 binary semaphores. The **semaphores are initialized as S0 = 1, S1 = 0, S2 = 0**.

//Process P0:	//Process P1:	//Process P2:

while(true)
{
wait(S0);
print '0';
release(S1);
release(S2);
}
	wait(S1);
	release(S0);
		wait(S2);
		release(S0);

In this situation, P0 print '0':

a) Exactly once
b) Exactly twice
c) Exactly three times
d) Exactly four times
e) None of the mentioned

Question 22 (2 point) – Each process Pi, i = 0,1,2,3,……,9 is coded as follows:

```
While (true) {
 wait(mutex)
 {Critical Section}
 signal(mutex)
}
```

The code for P10 is coded as follows:

```
While (true) {
 signal(mutex)
 {Critical Section}
 wait(mutex)
}
```

What is the largest number of processes that can be inside the critical section at any moment (the mutex being initialized to 1)?

a) One process
b) Two processes
c) Three processes
d) Four processes
e) None of the mentioned

Question 23 (1 point) – Deadlock prevention is a set of methods:

a) to ensure that at least one of the necessary conditions cannot hold
b) to ensure that all of the necessary conditions do not hold
c) to decide if the requested resources for a process have to be given or not
d) to recover from a deadlock
e) none of the mentioned

Question 24 (1 point) – To ensure that the hold and wait condition never occurs in the system, it must be ensured that:

a) whenever a resource is requested by a process, it is not holding any other resources
b) each process must request and be allocated all its resources before it begins its execution
c) a process can request resources only when one is available
d) All of the mentioned
e) None of the mentioned

Question 25 (1 point) – The following pair of processes share a common variable X:

```
//Process P1 :
{
  int Y;
  A1: Y = X*2;
  A2: X = Y;
}
```

```
//Process P2 :
{
  int Z;
  B1: Z = X+1;
  B2: X = Z;
}
```

X is set to 5 before either process begins execution. As usual, statements within a process are executed sequentially, but statements in process A may interleave with statements in process B. How many different values of X are possible after both processes finish executing?

a) 1
b) 2
c) 3
d) 4
e) 8

Question 26 (1 points) – Which of the following statements is **<u>true</u>** about pre-emptive Shortest Job First (SJF) scheduling:

ID	**Statement**
S1	It causes minimum average waiting time
S2	It may cause starvation

a) Only S1
b) Only S2
c) Both S1 and S2
d) Neither S1 nor S2

Question 27 (1 point) – The disadvantage of a process being allocated all its resources before beginning its execution is:

a) Low CPU utilization
b) Low resource utilization
c) Very high resource utilization
d) Very high CPU utilization
e) None of the mentioned

Question 28 (2 point) – A critical section is implemented using **xchg (a,b)** function, which is an **atomic** operation supported by hardware. If **b is global** bit initialized to 0, **k is local** bit initialized to 1, which of the following statements is true

```
while(true){
  k = 1
  while(k!=0)xchg(k,b);
  Critical Section
  xchg(k,b);
  Remainder Section
}
```

a) When a process is in the critical section the value of b=0, and the value of k=0
b) When a process is in the critical section the value of b=1, and the value of k=0
c) When a process is in the critical section the value of b=0, and the value of k=1
d) When a process is in the critical section the value of b=1, and the value of k=1

Question 29 (2 points) – Consider the following table of arrival time and burst time for three processes P0, P1 and P2. Assuming pre-emptive shortest job first scheduling algorithm is used. What is the average waiting time for the three processes?

Process	Arrival time	Burst Time
P0	0 ms	9 ms
P1	1 ms	4 ms
P2	2 ms	9 ms

a) 4.0 ms
b) 4.33 ms
c) 5.0 ms
d) 5.33 ms
e) 6.33 ms

Question 30 (2 points) – The **enter_CS()** and **leave_CS()** functions to implement a Critical Section (CS) of a process are realized using **test-and-set** instruction as follows:

```
void enter_CS(X){ while (test-and-set(&X)==false) ; }
void leave_CS(X){ X = 0; }

bool test-and-set(int *var){
  if (*var==0) {
    *var=1;
    return true;
  }
  else return false;
}
```

In the above solution, X is a memory location associated with the CS and is initialized to 0. Now consider the following statements:

ID	Statement
S1	Only one process is allowed to enter the CS
S2	The solution is starvation free
S3	The processes enter CS in FIFO order
S4	More than one process can enter CS at the same time

Which of the above statements is TRUE?

a) S1 only

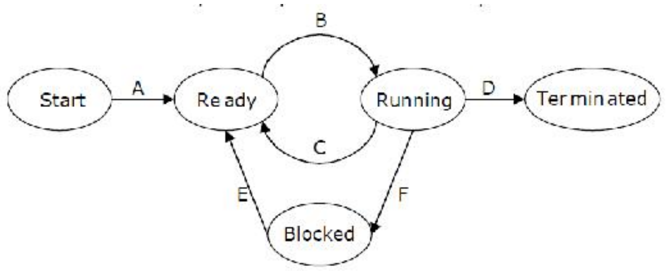
b) S1 and S2

c) S1 and S3

d) S2 and S3

e) S4 only

Question 31 (1 points) – In the following process state transition diagram for a uniprocessor system.



Which of the above statements are TRUE?

a) The OS is using pre-emptive scheduling.

b) The OS is not using pre-emptive scheduling.S2 and S3

Question 32 (1 point) – All unsafe states are:

a) deadlocks
b) not deadlocks
c) fatal
d) all of the mentioned
e) None of the mentioned

Question 33 (2 point) – A system has 12 magnetic tape drives and 3 processes: P0, P1, and P2. Process P0 requires 10 tape drives, P1 requires 4 and P2 requires 9 tape drives.

Process	Maximum Need	Currently Hold
P0	10	5
P1	4	2
P2	9	2

Which of the following sequence is a safe sequence?

a) P0, P1, P2
b) P1, P2, P0
c) P2, P0, P1
d) P1, P0, P2
e) None of the mentioned

Question 34 (2 point) – A system with 5 processes P0 through P4 and three resource types A, B, C has A with 10 instances, B with 5 instances, and C with 7 instances. At time t0, the following snapshot has been taken:

Process	Allocated				Max Required		
	A	B	C		A	B	C
P0	0	1	0		7	5	3
P1	2	0	0		3	2	2
P2	3	0	2		9	0	2
P3	2	1	1		2	2	2
P4	0	0	2		4	3	3

	A	B	C
Available	3	3	2

The sequence < P0, P1, P3, P4, P2 > of process termination is:

a) A proof that the current state is safe
b) Does not conclude the current state

Question 35 (1 point) – The logical address is different than the physical address in the following address binding schemes:

a) compile time
b) load time
c) execution time
d) all of the above
e) none of the above

Question 36 (1 point) – Consider the following statements and rank them as True (**T**) or False (**F**) respectively.

ID	Statement
S1	Paging suffers from internal fragmentation
S2	Paging suffers from external fragmentation
S3	Segmentation suffers from internal fragmentation
S4	Segmentation suffers from external fragmentation

a) TTTT
b) FTFF
c) FTFT
d) FTTT
e) FFFF

Question 37 (2 point) – A system with 32b address bus, is using a paging scheme with page size = 4KB. What is the maximum possible value of the page table length?

a) 1024 (or 2^{10})
b) 4096 (or 2^{12})
c) 104857 (or 2^{20})
d) 4294967296 (or 2^{32})

Question 38 (1 point) – The translation look-aside buffer (TLB) is used for:

a) Store the page table
b) Store the segment table
c) Cache the page table
d) Cache the segment table
e) All of the above

Question 39 (1 point) – The hashed page table scheme saves page table storage space by:

a) Storing only recently used pages in the page table
b) Reduce the page table length, but increase the table entry size
c) Reduce the page table length, and reduce the table entry size
d) Cache the page table
e) All of the above

Question 40 (2 point) – A system with 32b address bus, is using a paging scheme with page size = 4KB. Each entry in the process page table is 32 bits (or 4 Bytes), including tag/control bits. If the system is using 2 level paging where the outer level is 10b, and the inner level is 10b. If a process is using 16MB of memory, how many bytes will be used to store the page table?

a) 4 KB
b) 16 kB
c) 1 MB
d) 4 MB
e) 16 MB