**CPSC/ECE 3220 – Summer 2018 – Exam 1** **Name: _____**

Closed book / closed notes. No electronics.

1. Give the definition (note: not the roles) for an operating system as stated in the textbook. (2 pts.)

2. The textbook describes the OS acting in three different roles. Identify at least two distinct actions, features, or services provided by the OS in the role of glue. (2 pts.)

3. The four generic actions that hardware performs in response to an interrupt are: (1.5 pts. each)

4. What does an interrupt vector table contain? (1 pt.)

Kernel mode / User mode. Circle **one or both** of K and U, as applies. (2 pts. each)

5. K / U A load instruction is allowed to execute in this mode.
6. K / U An iret (interrupt return) instruction is allowed to execute in this mode.
7. K / U In this mode the processor limits the set of instructions that can be executed.
8. K / U In this mode the processor limits the set of physical memory addresses that can be accessed.

Process/Thread. Circle **one or both** of P or T, as applies. (2 pts. each)

9. P / T Has an associated control block.
10. P / T Has an associated data segment.
11. P / T Has an associated code segment.
12. P / T Has an associated heap segment.
13. P / T Has an associated SP (stack pointer).
14. P / T Has an associated PC (program counter).
15. P / T Has an associated PSR (processor status register).

True/False. Circle **only one** of T or F. (2 pts. each)

16. T / F An operating system kernel can use internal threads.
17. T / F Each interrupt handler has its own thread control block.
18. T / F A return from interrupt instruction should be a privileged instruction.
19. T / F To provide multiuser protection, hardware must have at least three execution modes.
20. T / F Threads are more expensive for the operating system kernel to create than processes.
21. T / F When a user attempts to execute a privileged instruction in user mode the CPU should stop.
22. T / F A loadable device driver means that the kernel does not have to be recompiled to use the device.
23. T / F The OS should be invoked by a syscall or trap instruction rather than a normal jump to subroutine.
24. T / F An operating system should never create more processes than the available number of processors.
25. T / F Users should not be allowed to write into the execution mode bit(s) in the processor status register.

26. Identify at least three locations identified in the textbook at which operating system functionality can be placed. (3 pts.)

Word Bank. Write one of the words or terms from the following list into the blank appearing to the left of the appropriate definition. Note that there are more words and terms than definitions. (2 pts. each)

| | | | | |
|---|---|---|---|---|
| asynchronous I/O | efficiency | green threads | guest OS | hardware timer |
| host OS | interrupt handler | mechanism | microkernel | monolithic kernel |
| policy | privileged instruction | process | program | protection |
| ready list | response time | running list | thread | trap |
| throughput | user stack | utilization | virtual machine | waiting list |

27. _____ The rate at which a group of tasks are completed.
28. _____ An operating system running in a virtual machine.
29. _____ The lack of overhead in implementing an abstraction.
30. _____ A kernel procedure invoked when an interrupt occurs.
31. _____ Instruction available in kernel mode but not in user mode.
32. _____ The time for a task to complete, from when it starts until it is done.
33. _____ A hardware device that can cause a processor interrupt after some delay.
34. _____ A single execution sequence that represents a separately schedulable task.
35. _____ The set of threads that are ready to be run but which are not currently running.
36. _____ An OS design where most of the OS functionality is linked together inside the kernel.
37. _____ A synchronous transfer of control from a user-level process to a kernel-mode handler.
38. _____ An execution context provided by an operating system that mimics a physical machine.
39. _____ An operating system that provides the abstraction of a virtual machine, to run another operating system as an application.
40. _____ The execution of an application program with restricted rights – the abstraction for protection provided by the operating system kernel.
41. _____ The isolation of potentially misbehaving applications and users so that they do not corrupt other applications or the operating system itself.
42. _____ A thread system implemented entirely at user-level without any reliance on operating system kernel services, other than those designed for single-threaded processes.

43. Why would one process need both a user stack and a kernel stack? (2 pts.)

44. What is the benefit of having device drivers run in user mode? (1 pt.)

45. Consider the following code pattern with variables x, y, and z. (1 pt. each)

```
int x;
…
int main(){
        …
        int y;
        …
        thread_create( &threads[i], &go, i );
        …
}
…
void go( int n ){
        …
        int z;
        …
}
```

a) In what type of memory segment is x located?

b) In what type of memory segment is y located?

c) In what type of memory segment is z located?

46. What action, event, or system call causes a thread to enter the Running state? (2 pts.)

47. What action, event, or system call causes a thread to enter the Waiting state? (2 pts.)

48. Why is it necessary to turn off interrupts during a thread switch? (2 pts.)