

**EXAM 1**  
**CS 450 – Spring 2010**  
**ANSWER KEY**

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This is a closed book test. No notes or other resources are allowed. Read each question carefully and pace yourself. Put all answers on the exam paper, in the space provided.

**1. (20 points: 2 each)**

**TRUE OR FALSE**

- a) A file is an example of a physical resource. FALSE  
*A file is a logical resource.*
- b) The first operating systems were developed in the 1950s. TRUE
- c) MS-DOS was written from scratch by Bill Gates. FALSE  
*Gates purchased the OS from Seattle Computer Products.*
- d) OS/360 was delivered on time and with few bugs. FALSE
- e) Shortest job first scheduling provides the shortest possible average waiting times. TRUE
- f) When a running process makes a request for resources, it is placed in the suspended state. FALSE  
*The process is initially placed in the blocked state.*
- g) In an interactive system, if context switching had no cost, it would be desirable to switch running processes infinitely often. TRUE
- h) When scheduling interactive processes using feedback queues, a process doing a long computation will be given a low priority and a short time quantum. FALSE  
*High priority, short TQ.*
- i) In all OSs in common use today, processes have character string names. FALSE
- j) In a typical computing system disk interrupts occur more often than any other type. FALSE  
*Timer interrupts are the most frequent.*

**2. (20 points: 4 each)**

Explain briefly each of the following terms.

a) Physical resource

*A resource consisting of a physical object such as memory or the processor.*

b) Dispatcher

*A component of a short term scheduler that is responsible solely for selecting the next process to run when the processor is free and performing the context switch. The process chosen is always the highest priority process that is in the ready state.*

c) Astonishment Factor

*Refers to a user interface feature that surprises the user by “taking charge” and doing something unexpected. Even if the action is possibly helpful, this is generally not welcomed by users.*

d) Aging

*A technique used to avoid starvation of low-priority processes in a priority-based scheduler. Periodically the priority of all processes in the queue is raised. Eventually the long-waiting processes will have a high enough priority to be scheduled.*

e) Re-entrant procedure

*A procedure that is designed in such a manner that it may be interrupted by a call to another instance of itself without incorrect behavior. Such a procedure must operate on private variables and parameters only, and may not access global variables or cause side effects.*

**3. (10 points: 5 each)**

- a. State the principal purpose of an operating system in a single sentence.

*An operating system is a manager of resources.*

- b. List five distinct resources managed by a typical OS.

- *processor*
- *memory*
- *I/O devices*
- *timers*
- *files*
- *processes*
- (*etc.*)

**4. (10 points: 2 each)**

Match an OS from the list given to each of the descriptive phrases below. You may use the same name more than once. Here is the list:

SHARE OS, SAGE, SABRE, ATLAS, OS/360, CTSS, MULTICS, T.H.E., UNIX, CP/M, MS-DOS, VMS, WINDOWS

- |  |                                |
|--|--------------------------------|
| 1. An OS written by a users group                                      | <u>    <i>SHARE OS</i>    </u> |
| 2. First system to provide virtual memory                              | <u>    <i>ATLAS</i>    </u>    |
| 3. Splits process creation into <b>fork</b> and <b>exec</b> operations | <u>    <i>UNIX</i>    </u>     |
| 4. Principal influence on design of Unix                               | <u>    <i>MULTICS</i>    </u>  |
| 5. Principal influence on design of Windows NT                         | <u>    <i>VMS</i>    </u>      |

**5. (10 points: 5 each)**

Give two rules you would follow when designing a command language, and briefly explain why.

*This is a wide open question. You may give any reasonable (!) rules you like. Typical rules may address consistent choice of terms, safety in drastic operations, use of a preferred syntax, etc. Be sure that you give a justification for your choices.*

**6. (10 points: 5 each)**

Answer the following questions about the basic process state diagram with three states.

- a) In what type of system would we find a transition from the running to the ready state?

*Transition from the running to the ready state would occur in **timesharing** systems, where processes may be stopped because their time is up, not only when they terminate or request resources.*

- b) Identify the one transition that will never be found in any OS.

*No system will provide a transition from blocked to running. Running processes are selected only from the ready queue.*

**7. (10 points)**

Name each of the three levels of process scheduling, and identify the resource or resources scheduled by each level.

1. *High-level or long-term: schedules complete jobs*
2. *Intermediate-level or medium-term: schedules memory*
3. *Low-level or short-term: schedules the processor*

**8. (10 points)**

Briefly state the reason for each of the following rules when writing an interrupt handler:

- a) The handler should avoid calling operating system routines.

*The handler should not call any routine that is not reentrant, if there is a possibility that the processor was executing that routine when interrupted. Programs spend much of their time in OS routines, and many OS routines manipulate global data structures, etc.*

- b) The handler should be as short as possible.

*When an interrupt is being handled, other interrupts may occur. The handler must choose between blocking or deferring other interrupts, allowing itself to be interrupted, or finishing quickly and getting out of the way. The last option is often the easiest.*