

**Question 6.1–1:** (Solution, p 3) The text describes three purposes of the operating system. Give two of them.

**Question 6.2–1:** (Solution, p 3) Describe the procedure an operating system performs to switch the process running on a CPU.

**Question 6.2–2:** (Solution, p 3) Say our computer has a time slice of 2 ms; it takes 1 ms to perform a context switch and 2 ms to access the disk. There are two processes in execution.

| Process A    | Process B    |
|--------------|--------------|
| compute 1 ms | compute 1 ms |
| access disk  | access disk  |
| compute 3 ms | compute 1 ms |

Complete the following table to show how the operating system will schedule these processes on the CPU. The front of each queue is the left end. There may be more blanks than necessary.

| time | CPU | ready | disk |
|------|-----|-------|------|
| 0    |     | AB    |      |
|      |     |       |      |
|      |     |       |      |
|      |     |       |      |
|      |     |       |      |
|      |     |       |      |
|      |     |       |      |
|      |     |       |      |
|      |     |       |      |
|      |     |       |      |
|      |     |       |      |
|      |     |       |      |

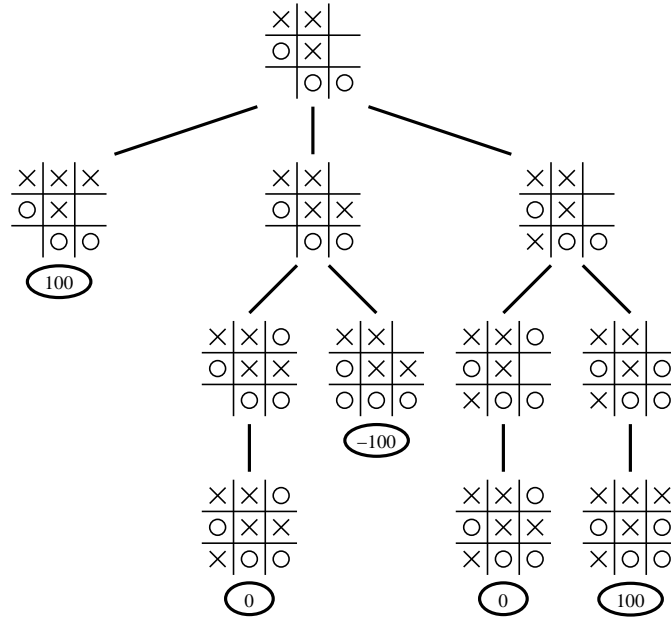
**Question 6.2–3:** (Solution, p 3) Suppose our computer system uses virtual memory with 12 pages, called  $P_0, P_1, \dots, P_{11}$ . Further, suppose that the system contains seven page frames, where each frame contains a page as follows.

| frame | page     |
|-------|----------|
| $F_1$ | $P_5$    |
| $F_2$ | $P_4$    |
| $F_3$ | $P_2$    |
| $F_4$ | $P_7$    |
| $F_5$ | $P_{10}$ |
| $F_6$ | $P_3$    |
| $F_7$ | $P_0$    |

Draw a diagram of the page table.

**Question 6.2–4:** (Solution, p 4) Suppose we have a system using paging. Outline the process the system goes through each time a program attempts to load something from memory. Suppose that the memory occurs in page 9 of virtual memory, and this page is currently loaded in page frame 3 of RAM.

**Question 7.1–1:** (Solution, p 4) Label *all* internal nodes of the following tic-tac-toe game tree with the value that minimax search would compute. I’ve already labeled the leaves.



**Question 7.1–2:** (Solution, p 4) The game of Nim proceeds by players taking turns selecting a pile and removing stones from that pile. The player removing the last stone wins.

Draw a complete game tree for the game of Nim beginning with two piles, both containing two stones. To draw a node, list the number of stones in each pile; for example, the top node will be “2,2.”

Do not include the minimax values assigned to each node in your tree.

**Question 7.2–1:** (Solution, p 4) Describe the Turing Test and why Turing proposed it (i.e., its purpose).

**Solution 6.1–1:** (Question, p 1)

- The operating system abstracts computer resources.
- The operating system provides hardware compatibility.
- The operating system protects the overall computer system.

**Solution 6.2–1:** (Question, p 1) Suppose the process currently using the CPU is process *A*.

1. The operating system stores the contents of all registers, including the program counter (which holds the address of the next instruction *A* wishes to execute), into memory the OS has dedicated to remembering *A*'s registers.
2. The operating system selects which process to run next. Suppose this is process *B*.
3. The operating system restores the contents of all registers from memory the OS dedicated to remembering *B*'s registers.
4. The operating system jumps to the current instruction within *B*.

**Solution 6.2–2:** (Question, p 1)

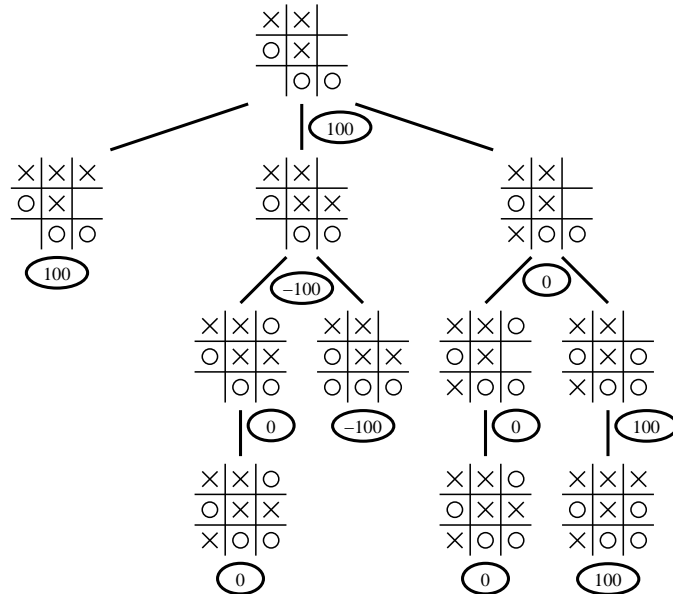
| time | CPU | ready | disk |
|------|-----|-------|------|
| 0    |     | AB    |      |
| 1    | A   | B     |      |
| 2    |     | B     | A    |
| 3    | B   |       | A    |
| 4    |     | A     | B    |
| 5    | A   |       | B    |
| 6    | A   | B     |      |
| 7    |     | BA    |      |
| 8    | B   | A     |      |
| 9    |     | A     |      |
| 10   | A   |       |      |
| 11   |     |       |      |

**Solution 6.2–3:** (Question, p 1)

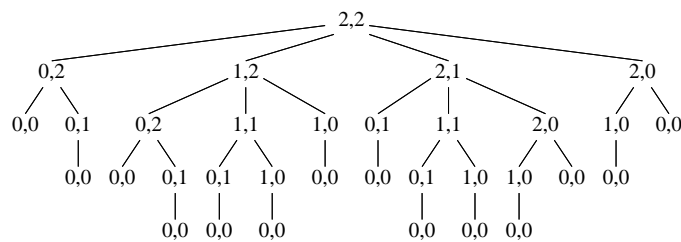
| index | contents |
|-------|----------|
| 0     | 7        |
| 1     | 0        |
| 2     | 3        |
| 3     | 6        |
| 4     | 2        |
| 5     | 1        |
| 6     | 0        |
| 7     | 4        |
| 8     | 0        |
| 9     | 0        |
| 10    | 5        |
| 11    | 0        |

**Solution 6.2–4:** (Question, p 1) The CPU first looks at entry 9 of the page table in RAM, to determine the page’s location. If this entry says “0,” the CPU would force the operating system to load page 9 into RAM. In this case, though, it would find a 3 in the entry, and so the CPU would go to page frame 3 in RAM to find the requested data.

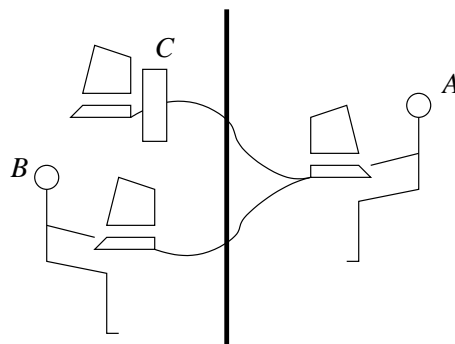
**Solution 7.1–1:** (Question, p 1)



**Solution 7.1–2:** (Question, p 2)



**Solution 7.2–1:** (Question, p 2) Turing proposed that a person and a computer hide behind a screen connected via a communication link to a human tester. The tester poses questions to each and tries to distinguish which is the human. If the tester can’t reliably determine which is the human, the computer has “passed” the test.



The purpose of Turing’s test is to be a specific, meaningful goal toward which artificial intelligence researchers can strive.