

**Question 9.2.3-1:** (Solution, p 2) Restate the Church-Turing thesis in your own words.

**Question 9.3-1:** (Solution, p 2) Define the halting problem.

**Question 9.3-2:** (Solution, p 2) Consider the following choices.

- A the first is contained within the second
- B the second is contained within the first
- C neither is contained within the other
- D the languages are identical

Choose which of these choices best describes each of the following pairs of language classes.

- a. languages described by regular expressions; languages accepted by finite automata
- b. languages described by context-free grammars; languages described by regular expressions
- c. languages described by context-free grammars; languages accepted by Turing machines
- d. languages accepted by finite automata; languages accepted by Turing machines

**Solution 9.2.3–1:** (Question, p 1) The Turing machine model is computationally as powerful as any other computational model. (Actually, the Turing thesis is restricted to finite models.)

**Solution 9.3–1:** (Question, p 1) The halting problem is the set of strings of the form  $M!x$  where  $M$  is the string representation of a Turing machine, and  $M$  does not accept the string  $x$  as part of the language it recognizes.

**Solution 9.3–2:** (Question, p 1)

- a. D. the languages are identical
- b. B. the second is contained within the first
- c. A. the first is contained within the second
- d. A. the first is contained within the second