SE 2A04 Fall 2000

Midterm Test 1 Answer Key

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You have 50 minutes to complete this test consisting of 4 pages and 18 questions. You may use your notes and textbooks. Circle the *best* answer for the multiple choice questions, and write the answer to the other questions in the space provided. Each answer you write should be either a technical expression or a sentence or phrase in English. If you answer a question with more than one sentence, only the first sentence will be read for marking; all others will be ignored. Good luck!

(1) [5 pts.] Finite state machines are more practical for software design than Turing machines? Is this statement true or false?

(a) $\boxed{\text{True.}}$
(b) False.

(2) [5 pts.] The professional responsibilities of a software engineer strongly differ from those of a mechanical engineer. Is this statement true or false?

(a) True.
(b) $\boxed{\text{False.}}$

(3) [5 pts.] A software product requires exactly one specification. Is this statement true or false?

(a) True.
(b) $\boxed{\text{False.}}$

(4) [5 pts.] Software maintenance is a strong preventive measure against software aging. Is this statement true or false?

(a) True.
(b) $\boxed{\text{False.}}$

(5) [5 pts.] Project management is an important component of software engineering? Is this statement true or false?

(a) $\boxed{\text{True.}}$
(b) False.

(6) [5 pts.] What is the Unix command `su` used for?

Answer: The `su` command enables the current user to be changed to another user.

(7) [5 pts.] Suppose X is the set of integers inductively defined by the following statements:

(a) Every integer that is a multiple of 4 is a member of X.

(b) If x is a member of X, then both $x-2$ and $x+2$ are members of X.

In one sentence as simply as possible, describe the set X.

Answer: X is the set of even integers.

(8) [5 pts.] Consider the Turing machine M with the following components:

(a) The set of symbols is $\{1, B\}$ (B represents the blank symbol).

(b) The set of states is $\{q_1, q_2, q_3\}$.

(c) The transition relation contains the following quadruples:

i. $(q_1, 1, R, q_2)$.

ii. $(q_2, 1, R, q_3)$.

iii. $(q_3, 1, B, q_3)$.

If the Turing machine is started in state q_1 with the tape head above the first 1 on the tape $\ldots, B, B, B, 1, 1, 1, 1, 1, B, B, B, \ldots$, what will be on the tape after M halts.

Answer: $\ldots, B, B, B, 1, 1, B, 1, 1, B, B, B, \ldots$

(9) [5 pts.] If the absolute pathname of the current directory is

`/trigger/george/xdoo/istop`

what is the absolute pathname of the file described by the relative pathname

`./../../happy.c`

Answer: `/trigger/george/happy.c`

(10) Suppose that the access privileges of a Unix file are `rwxrw-r--`.

(a) [4 pts.] Which users are allowed to read this file?

Answer: All users.

(b) [4 pts.] Which users are allowed to execute this file?

Answer: The owner of the file and root.

(11) Let I be the set of character strings over the modern Roman alphabet and O be the set of characters in the modern Roman alphabet. Consider the input/output rule R that associates $i \in I$ with $o \in O$ precisely if the character o occurs exactly twice in the string i.

(a) [4 pts.] Is R total? Answer: No.

(b) [4 pts.] Is R deterministic? Answer: No.

(12) Consider the following functions defined with lambda-notation:

(a) $f = (\lambda\, x : \mathbf{Z}\,.\; x * x)$.

(b) $g = (\lambda\, x : \mathbf{Z}\,.\; f(x) + f(x))$.

What is the value of the following expressions:

(a) [3 pts.] $(\lambda\, z : \mathbf{Z}\,.\; z - 2)(6)$. Answer: 4.

(b) [3 pts.] $f(3)$. Answer: 9.

(c) [3 pts.] $g(2)$. Answer: 8.

(13) [5 pts.] What is one example of a *means of abstraction* used in the C programming language?

Answer: Variable declaration or function definition.

(14) [5 pts.] What is the purpose of an interpreter for a programming language?

Answer: An interpreter is a program that takes as input a program P of the programming language and then executes P line by line.

(15) [5 pts.] Give an example of a *reactive* software system.

Answer: An operating system or a user interface.

(16) [5 pts.] What is needed to determine if a software product works correctly?

Answer: A specification of the requirements of the software product.

(17) [5 pts.] Why is it cumbersome to view a program as a sequence of instructions for a machine?

Answer: Understanding a program entails understanding the machine itself.

(18) [5 pts.] Why do software engineers need to understand physics?

Answer: Software engineers may be called upon to design software that is part of a physical product that interacts with the physical world such as a car or a plane.