

Name\_\_\_\_\_ Student ID\_\_\_\_\_ Department/Year\_\_\_\_\_

## **Final Examination**

Introduction to Computer Science  
Class#: 901 E10110, Session#: 03  
Spring 2010

15:40-17:20 Wednesday  
June 23, 2010

### **Prohibited**

1. You are not allowed to write down the answers using pencils. Use only black- or blue-inked pens.
2. You are not allowed to read books or any references not on the question sheets.
3. You are not allowed to use calculators or electronic devices in any form.
4. You are not allowed to use extra sheets of papers.
5. You are not allowed to have any oral, visual, gesture exchange about the exam questions or answers during the exam.

### **Cautions**

1. Check if you get **8** pages (including this title page), **15** questions.
2. Write your name (in Chinese), student ID, and department/year down on top of the cover page.
3. There are in total **100** points to earn. You have **100 minutes** to answer the questions. Skim through all questions and start from the questions you feel more confident with.
4. You are allowed to use **either English or Chinese** to answer the questions. Misspelling and grammar errors will be tolerated, but you want to make sure with those errors your answers will still make sense.
5. If you have any extra-exam emergency or problem regarding the exam questions, raise your hand quietly. The exam administrator will approach you and deal with the problem.

1. Describe the steps followed by a machine that wants to transmit a message in a network using the CSMA/CD protocol. (5%)

ANSWER:

Refer to the exercise solution.

2. Name at least one distinction between UDP and TCP? (5%)

ANSWER:

(1) UDP is a connectionless protocol whereas TCP establishes a two way communication between the origin and destination of a message.

(2) TCP is a reliable protocol in that the origin and destination work together to confirm that the entire message was successfully transferred. In contrast, UDP merely transmits the message without confirming its reception.

3. What is the difference between a formal programming language and a pseudocode?  
(5%)

ANSWER:

Refer to the exercise solution.

4. The Euclidean algorithm finds the greatest common divisor of two positive integer X and Y by the following process:

As long as the value of neither X nor Y is zero, continue dividing the larger of the values by the smaller and assigning X and Y the values of the divisor and remainder, respectively. (The final value of X is the greatest common divisor.)

Express this algorithm using the pseudocode primitives (10%)

ANSWER:

```
while (X is not 0 and Y is not 0) do
  TempX ← X
  TempY ← Y
  X ← the smaller of TempX and TempY
  Y ← the larger of TempX and TempY
  Y ← the remainder of X divides Y
X is the answer
```

5. What sequence of numbers would be printed when the following procedure are executed? (5%)

```
X ← 5;
while (X < 7) do
  (print the value of X;
   X ← X + 1)
print the value of X;
while (X > 2) do
  (print the value of X;
   X ← X - 2)
```

ANSWER: 5, 6, 7, 7, 5, 3

6. When searching for the entry X within the list:

L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z

(Note that the list is in alphabetical order.)

(a) how many entries will be considered before discovering that the entry is present using the sequential search algorithm? (5%)

(b) how many entries will be considered before discovering that the entry is present using the binary search algorithm? (5%)

ANSWER:

(a) 13, (b) 4

7. What sequence of numbers would be printed if the following procedure were executed with the value of N being 0? (5%)

```
procedure xxx (N)
print the value of N;
if (N < 3) then (apply the procedure xxx to the value N + 1);
print the value of N
```

ANSWER: 0, 1, 2, 3, 3, 2, 1, 0

8. Use a while loop structure to produce a non-recursive program segment that prints the same sequence of numbers as the following recursive procedure. (10%)

```
procedure Factorial (Value)
  if (Value is 0)
    then Return 1 as the answer
  else Apply Factorial to (Value - 1),
        multiply the result by Value, and
        X ← the value of this product,
        Return the number assigned to X as the answer
```

ANSWER:

```
procedure Factorial (Value)
  X ← value
  Y ← 1
  while (X >= 1) do
  (
    Y ← Y multiply X
    X ← X-1
  )
  Return Y as the answer
```

9. Does the loop in the following routine terminate? (5%)

```
X ← 3
while (X ≠ 7) do
  (X ← X + 1)
```

ANSWER:

Yes

10. Does the loop in the following routine terminate? (5%)

```
X ← 3
while (X > 0) do
  (X ← X + 1)
```

ANSWER:

No

11. The following is a program segment and the definition of a procedure named sub.

```
X ← 5;                                procedure sub (Y)
sub (X);                                Y ← 3;
print the value of X;
```

(a) What value will be printed by the program segment if parameters are passed by value? (5%)

(b) What value will be printed by the program segment if parameters are passed by reference? (5%)

ANSWER: A. 5    B. 3

12. Based on the sketch of a class definition below, which methods can be invoked from outside an instance of the class? (5%)

```
class Example
{private void method1( )
  { . . . }
  public void method2( )
  { . . . }
  private void method3( )
  {...}
  public void method4( )
  { . . .}
}
```

ANSWER: method2 and method4

13. In the chapter 12, we saw how the statement

```
copy name1 to name2;
```

could be simulated in Bare Bones. Show how that statement could still be simulated if the `while` loop structure in Bare Bones were replaced with a posttest loop expressed in the form: (5%)

```
repeat ... until (name equals 0);
```

ANSWER:

```
incr name1;
clear name2;
repeat
  incr name2;
  decr name1;
until (name1 equals 0);
decr name2;
```

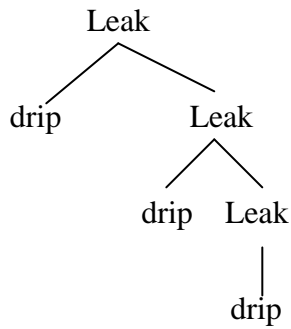
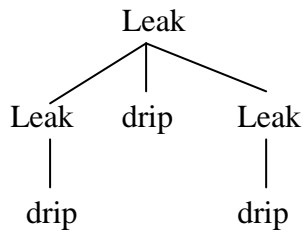
14. Show that the grammar below is ambiguous by drawing two distinct parse trees for the string “drip drip drip.” (10%)

**Leak:**



ANSWER:

Possible answers include:



15. Is a polynomial solution to a problem always better than an exponential solution? Explain your answer. (5%)

ANSWER:

Refer to the exercise solution.