CSC104 The How and Why of Computing
Winter 2008
Term Test 1

Friday, February 29, 2008
9:10 a.m. (50 minutes)

No aids allowed
Solutions

Question 1 [5 marks] Multiple choice and short answer:
Circle the letter(s) which represent the correct answer(s):
a. What algorithm did ancient Egyptians use to find right angles in architecture? 1 mark- if right -1/2 if wrong
    A. Pythagoras theorem
    B. Multi-sided polygon approximation
    C. Listing and indexing
    D. Binary counting

b. Why do modern computers use the binary system? 1 mark- if right -1/2 if wrong
    A. It appeals to discrete mathematicians.
    B. It is the simplest number system for computers to implement.
    C. Semiconductors have two readily transferable states.
    D. None of the above

Complete the following:
c. According to *Polya*, the four phases of problem solving are: (2 marks – ½ mark each)

    Phase 1: Understand the problem

    Phase 2: Devise a plan for solving the problem

    Phase 3: Carry out the plan

    Phase 4: Evaluate the solution for accuracy & for its potential as a tool for solving other problems.

d. Three of the techniques that we use to solve problems are: (1 mark - ½ mark each missing technique)

    1: Analogy, Auxiliary elements, Auxiliary problems, Bright idea, Can you use the result? Decomposing & recombining, Definition, Examine your guess

    2: Figures, Stepwise refinement, Have you seen it before?, Induction, Subconscious work, Did you use all the data?, Look at the unknown, Working backwards

    3: (Any three of the above)

e. Summarize (briefly) the difference between *batch* processing and *interactive* processing: (1 mark, - ½ mark for if either batch or interactive desc is missing).

    Batch is: Serial processing, Waiting jobs sit on a job queue until they can be processed, Things processed in first-in first-out order (FIFO). Interactive processing allows dialogue through remote terminals, actions of computer can be coordinated with the actions of the user. (e.g., word processor) Through time-sharing, interactive processing appears to be processing multiple jobs at once.

Question 2 [5 marks] Describe the output:

Given the following code:

```
def countdownByTwo(nbr):
    while(nbr > 0):
        print nbr,
        nbr = nbr - 2
    print
    return

def countdownByThree(nbr):
    while(nbr > 0):
        nbr = nbr - 3
        print nbr,
    print
    return

a = 15
print a
countdownByTwo(a)
countdownByThree(a)
print a
```

In the space below, show exactly what will be displayed (printed) when the above code is executed:
5
15 13 11 9 7 5 3 1
12 9 6 3 0
15
>>>

Question 3 [5 marks] Correct the code:
Given the following two files (note that line numbers are displayed for reference puposes only
and should not be considered part of the code):
File 1: `charCount.py`

```
01# This function accepts a line of text and a character
02# and returns the number of times the character occurs
03# in the line of text.
04def charCount(line, char) ①
05    a = 0: ②
06    count = 0
07    while a <= len(line): ⑦
08        if line[a] == char:
09            count = count + 1  ③
10    retu rn ④
```

File 2: `testCharCount.py`

```
01# This program tests the charCount function by executing
02# it with a line of text and a character.
03import charCount.py ⑤
04 print charCount('Hi how are you today','o') ⑥
```

There are at least five mistakes in the above code. First, You must identify five errors. In the
above code, you must first tag the each code error with a circled error number. e.g. ①
Then in the space below, describe each error you have tagged, and the correct code.
-1 mark for each missing error of five required.

① Why it is wrong: colon is missing
   Correct code is: `def charCount(line, char):`

② Why it is wrong: should not end in colon
   Correct code is: `a = 0`

③ Why it is wrong: need to increment a or will end up in endless loop
   Correct code is: a = a + 1

④ Why it is wrong: need to return the count
   Correct code is: return count

⑤ Why it is wrong: should not use .py suffix on file to be imported – python knows it is a python file.
   Correct code is:

⑥ Why it is wrong: need to reference the file that the function being executed is in
   Correct code is: `print charCount.charCount('Hi how are you today','o')`

⑦ Why it is wrong: <= should be < because otherwise it will abort with an out of bound condition
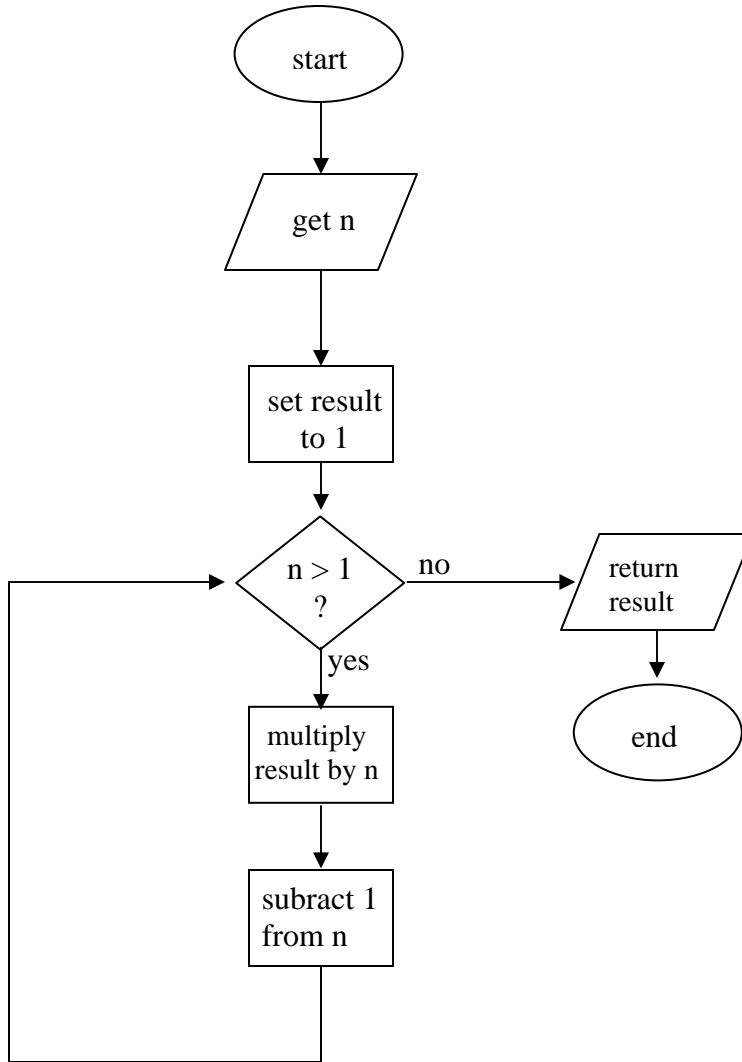   Correct code is: `while a < len(line):`

Question 4 [8 marks] Flowchart and Pseudocode

We would like to create an algorithm for n factorial (written `n!`).
`n! =  n × (n − 1) × (n − 2) × (n − 3) × … × 1`
That is, you multiply n by each number successively less than n until you get down to 1.

In the area below, draw the flowchart to describe this algorithm:

```
                    ┌─────────┐
                    │  start  │
                    └────┬────┘
                         │
                    ╱─────────╲
                   ╱   get n   ╱
                   ╲─────────╱
                         │
                    ┌─────────┐
                    │ set result │
                    │   to 1   │
                    └────┬────┘
                         │
                     ◇ n > 1 ◇ ── no ──▶  ╱ return ╱
                       ?                   ╱ result ╱
                         │ yes                 │
                    ┌─────────┐           ┌───────┐
                    │ multiply │          │  end  │
                    │result by n│         └───────┘
                    └────┬────┘
                         │
                    ┌─────────┐
                    │ subract 1│
                    │  from n  │
                    └────┬────┘
                         │
                    (loop back to n > 1)
```

1 mark input and output (-½ mark each missing)
2 marks loop ok (- ½ mark each missing piece)
1 mark start/end symbols (-½ mark each missing)

In the area below, write the pseudocode (as taught in class) to describe this algorithm:

```
procedure nFactorial(n)
{
     result ← 1
     do {
          result ← result times n
          n ← n - 1
     } while n > 1
     return result
}
```

```
1 mark for signature
1 mark for loop
1 mark for setting using  ← to set value
1 mark for returning value
```

Question 5 [7 marks] Write and test a function

In the space below, in Python, define the function `nPlus` that accepts a number n, and returns the sum of every number between n and 1 (inclusively).

```
def nPlus(n):
     result = 0
     while (n > 0):
          result = result + n
          n = n -1
     return result
```

1 mark signature
1 mark initialization of result
1 mark loop
1 mark decrement of n
1 mark return of value
1 mark proper indentation

In the space below, write the code to execute the function `nPlus` for the number 6, and print the returned value.

```
print nPlus(6)
```

1 mark correct function call with print