EECE.2160: ECE Application Programming

Spring 2019

Exam 1 Solution

1. (46 points) ***C input/output; operators***

a. (13 points) Show the output of the short program below exactly as it will appear on the screen. Be sure to clearly leave spaces between characters when necessary.

You may use the available space to show your work as well as the output; just be sure to clearly mark where you show the output so that I can easily recognize your final answer.

```
int main() {
   int i, j, k;
   double d1, d2, d3;

   i = 3;
   d1 = 11.0;

   j = i * 1.5 + d1 / 2;          j = 3 * 1.5 + 11.0 / 2 = 4.5 + 5.5
                                    = 10

   k = j % (i + 1);               k = 10 % (3 + 1) = 10 % 4 = 2

   d2 = d1 / 100 + 0.8;           d2 = 11.0 / 100 + 0.8 = 0.11 + 0.8
                                     = 0.91

   d3 = j + 0.32597;              d3 = 10 + 0.32597 = 10.32597

   printf("%d %d %d", i, j, k);
   printf("\number: %lf\n", d1);
   printf("%.0lf %.3lf\n", d2, d3);

   return 0;
}
```

OUTPUT:

```
3 10 2
umber: 11.000000
1 10.326
```

1 (continued)

b. (13 points) For this program, assume the user inputs the line below. The digit `'1'` is the first character the user types. There is one space (`' '`) between the `'7'` in `1.97` and the `'$'`, one space between the `'8'` in `2.38` and the `'2'` in `20.6`, and two spaces between the `'6'` in `20.6` and the `'+'`. There is no space between `'+'` and `'5'`.

You must determine how `scanf()` handles this input and then print the appropriate results, exactly as they would be shown on the screen. The program may not read all characters on the input line, but `scanf()` will read something into all nine variables declared in the program. There are no formatting errors in the input!

```
     1.97 $2.38 20.6  +5

int main () {
   int int1, int2;
   double d1, d2, d3;
   char ch1, ch2, ch3, ch4;

   scanf("%d%c%d %c%lf%c%lf %c%lf",
          &int1, &ch1, &int2, &ch2, &d1,
          &ch3, &d2, &ch4, &d3);

   printf("%d %d\n", int1, int2);
   printf("%.2lf %.2lf %.2lf\n", d1, d2, d3);
   printf("%c%c%c%c\n", ch1, ch2, ch3, ch4);
   return 0;
}
```

SOLUTION:

This program reads its input as follows:

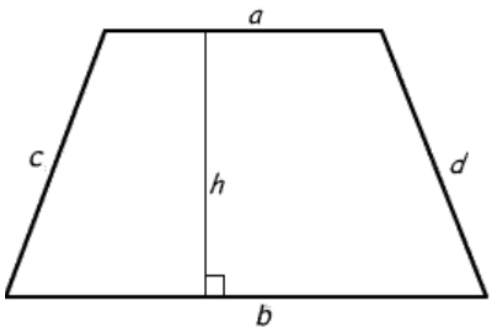
- *int1 is the first integer value* → *int1 = 1*
- *ch1 is the first character after 1* → *ch1 = '.'*
- *int2 holds the next whole number* → *int2 = 97*
- *ch2 is the first non-space character after 97* → *ch2 = '$'*
- *d1 holds the next number* → *d1 = 2.38*
- *ch3 is the first character after 2.38* → *ch3 = ' '*
- *d2 holds the next number* → *d2 = 20.6*
- *ch4 is the first non-space character after 20.6* → *ch4 = '+'*
- *d3 holds the next number* → *d3 = 5*

OUTPUT: *Note that all double-precision values are printed with a precision of 2.*

```
1 97
2.38 20.60 5.00
.$ +
```

1 (continued)

c. (20 points) Complete this program, which reads the dimensions of a trapezoid with base a, base b, side c, side d and height h, reprint the dimensions, and calculate and print the area and perimeter. Note:



- To calculate a trapezoid's area, add the two bases, multiply that sum by the height, and divide by two.
- To find the perimeter, add the bases and sides.

The formatting of your output should exactly match the formatting of the two test cases below, in which user input is underlined:

```
Enter a, b, c, d, h: 4 7 2.2 2.8 2
Base a: 4.00
Base b: 7.00
Side c: 2.20
Side d: 2.80
Height h: 2.00
Area: 11.000
Perimeter: 16.000
```

```
Enter a, b, c, d, h: 10 18 17.7 16.6 17
Base a: 10.00
Base b: 18.00
Side c: 17.70
Side d: 16.60
Height h: 17.00
Area: 238.000
Perimeter: 62.300
```

```
int main() {
   double a, b, c, d, h;    // Bases, sides, and height of trapezoid

   // Prompt for and read dimensions
   printf("Enter a, b, c, d, h: ");
   scanf("%lf %lf %lf %lf %lf", &a, &b, &c, &d, &h);

   // Reprint dimensions
   printf("Base a: %.2lf\n", a);
   printf("Base b: %.2lf\n", b);
   printf("Side c: %.2lf\n", c);
   printf("Side d: %.2lf\n", d);
   printf("Height h: %.2lf\n", h);

   // Calculate and print area and perimeter
   printf("Area: %.3lf\n", (a+b)*h/2.0);
   printf("Perimeter: %.3lf\n", a+b+c+d);
   return 0;
}
```

2. (34 points) ***Conditional statements***

a. (14 points) For the short program shown below, the first line of output (the prompt "`Enter 2 chars & int: `") and the user input (`Ex1`) is listed at the bottom of the page.

Complete the rest of the output for this program, given those input values.

```
int main() {
   char c1, c2;
   int v1;
   printf("Enter 2 chars & int: ");
   scanf("%c%c%d", &c1, &c2, &v1);     c1 = 'E', c2 = 'x', v1 = 1

   switch (c1) {
   case 'E': case 'e':                 Since c1 == 'E', program
      printf("Exam\n");                   prints "Exam\n"
   case 'T': case 't':                 Since this switch has no
      printf("Test\n");                   break statements, program
   default:                               also prints "Test\n" and
      printf("Neither\n");                "Neither\n"
   }

   switch (c2) {
   case '1':
      printf("%c%d\n", c2, v1);
      break;
   case 'x':
      printf("%d%c\n", v1, c2);      Since c2 == 'x', program
      break;                            prints 1x, then breaks
   default:
      printf("No match\n");
   }

   return 0;
}
```

OUTPUT (the first line is given; write the remaining line(s)):

Enter 2 chars & int: Ex1
Exam
Test
Neither
1x

2 (continued)

b. (20 points) Complete this program that reads three values and checks if they could represent the sides of a triangle, and, if so, if that triangle is equilateral, isosceles, or scalene. To test for each triangle type, your program should check the conditions below:

- If the sum of two sides is less than or equal to the third side, print “Triangle is not valid"
- Otherwise, if all sides are equal, print "Equilateral triangle "
- If only two sides are equal, print "Isosceles triangle "
- If no sides are equal, print "Scalene triangle"

Three test cases are shown below, with user input underlined.

```
Enter sides: 1 10 10      Enter sides: 2.2 2.2 2.2     Enter sides: 3.3 3 33.33
Isosceles triangle        Equilateral triangle         Triangle is not valid
```

```
int main() {
   double s1, s2, s3;          // Triangle side lengths

   /* Prompt for and read sides of a triangle */
   printf("Enter sides: ");

   scanf("%lf %lf %lf",&s1, &s2, &s3);

   // Check for possible results described above
   if (s1 + s2 <= s3 || s1 + s3 <= s2 || s2 + s3 <= s1)
      printf("Triangle is not valid");

   else if (s1 == s2 && s2 == s3)
      printf("Equilateral triangle");

   else if (s1 == s2 || s2 == s3 || s1 == s3)
      printf("Isosceles triangle");

   else
      printf("Scalene triangle");

   return 0;
}
```

3. (20 points, 5 points each) ***While and do-while loops***

a. What is the output of the short code sequence below? **Choose only one answer.**

```
x = 9;
while (x > 1) {
   printf("%d ", x);
   x = x / 2;
}
```

i. No output—the loop condition is initially false

ii. 9

iii. 9 4

iv. 9 4 2

v. 9 4 2 1

b. Given the code sequence below:

```
int inval;
int n = 0;
do {
   scanf("%d", &inval);
   n = n + 1;
} while (inval > 1 && inval <= 7);
```

Which of the following possible input values will cause the do-while loop to continue? In other words, which value(s) will cause the loop condition to be true? **This question has at least one correct answer, but may have more than one correct answer! Circle ALL choices that correctly answer the question.**

i. 0

ii. 1

iii. 5

iv. 7

v. 9

3 (continued)

c. Which loops below produce the following output?

```
* * * *
```

This question has at least one correct answer, but may have more than one correct answer! Circle ALL choices that correctly answer the question.

i.
```
int a = 4;
while (a < 0) {
   printf("* ");
   a = a - 1;
}
```

ii.
```
int b = 0;
do {
   b = b + 1;
   printf("* ");
} while (b <= 3);
```

iii.
```
int c = 7;
while (c) {
   c = c / 2;
   printf("* ");
}
```

iv.
```
int d = 1;
do {
   printf("* ");
   d = d * 3;
} while (30 > d);
```

d. Which of the following statements accurately reflect your opinion(s)? Circle all that apply (but please don't waste too much time on this "question")! ***All answers are "correct."***

i. "This course is moving too quickly."

ii. "This course is moving too slowly."

iii. "I've attended very few lectures, so I don't really know what the pace of the course is."

iv. "I hope the next exam is as easy as this question."

4. (10 points) ***EXTRA CREDIT***

REMEMBER, YOU CANNOT GET EXTRA CREDIT WITHOUT WRITING AT LEAST PARTIAL SOLUTIONS FOR ALL OTHER PROBLEMS ON THE EXAM.

Complete the program below, which calculates a value that contains the digits of its input value, `inval`, in reverse. For example, if `inval = 456`, its reverse is `654`; if `inval = 2019`, its reverse is `9102`. The general algorithm requires you to isolate each digit, add it to a running total, then remove that digit from the remaining total. For example, the steps required for reversing 456 would be:

- Current digit = 6 → Running total = 6, remaining total = 45
- Current digit = 5 → Running total = 65, remaining total = 4
- Current digit = 4 → Running total = 654, remaining total = 0

```
int main() {
     int inval;          // Input value
     int dig;            // Current digit
     int res;            // Running total (becomes final result)

     // Prompt for and read limit
     printf("Enter input value: ");
     scanf("%d", &inval);

     // COMPLETE PROGRAM AS DESCRIBED ABOVE
     res = 0;
     while (inval != 0) {
        dig = inval % 10;
        res = (res * 10) + dig;
        inval = inval / 10;
     }

     printf("Final result: %d\n", res);
     return 0;
}
```