King Fahd University of Petroleum & Minerals
College of Computer Sciences and Engineering

ICS 103: Programming in C (Term 083)

Major Exam I

Date & Time: Wednesday July 29, 2009 [7:30PM-9:30PM]

Duration: 2 Hours

Student ID#						
Student Name	**KEY**					
Sec#						

Question	Max. Grade	Obtained Grade
1	20	
2	26	
3	15	
4	17	
5	22	
Total	**100**	

Notes.
1. Make sure you have **Seven** pages including the cover page.
2. Closed book and notes
3. Write clearly, briefly and precisely
4. Cheating will result in ZERO grade

Question 1 (20 points):

Fill in the blank in each of the following:

(1) The <u>Central Processing Unit (CPU)</u> is the component that serves as the "brain" of a computer system.

(2) <u>Design</u> is the stage of the software development method in which you write an algorithm.

(3) The inputs and outputs of a problem are identified in the <u>analysis</u> step of the software development method.

(4) Compilers can find <u>syntax</u> errors (violations of the grammar rules of the high-level language) in source files.

(5) The expression 40/3/2.0 evaluates to <u>6.5</u>.

(6) The expression (int) (15/2.0)/2.0 evaluates to <u>3.5</u>.

(7) The expression 5&&6!=1evaluates to <u>1</u>.

(8) The expression 2<6%4+1 evaluates to <u>1</u>.

(9) The expression 4<6&&!3<=-1+2 evaluates to <u>1</u>.

(10)   Given the expression !(a>=b || !(a<c)), an equivalent expression with less number of operations is <u>a<b && a<c</u>.

Question 2 (9+12+5 points):

i)   Use parentheses only if necessary and write the equivalent expression in C program:

$1 + \dfrac{x+y}{b}$	**1+(x+y)/b**
$\sqrt{\dfrac{y^5+x}{a+\lvert b\rvert}} + 2z$	**sqrt((pow(y,5)+x)/(a+fabs(b)))+2*z**
$x = \dfrac{-b - \sqrt{b^2 - 4ac}}{2a}$	**x=(-b-sqrt(b*b-4*a*c))/(2*a);**

ii)   Write the equivalent condition for each of the following in a C program

x and y greater than or equal z	**x>=z && y>=z**
x + y is not greater than z and is smaller than 3	**x+y <=z && x+y <3** **or** **!(x+y>z)&& x+y <3**
x equals 5 and y is not less than 10	**x==5&&y>=10** **Or** **x==5&&!(y<10)**
x is even and y equals 2	**x%2==0 && y==2**

iii)   Rewrite the following C code fragment using switch statement instead of if-else-if structure:

| ```
if(i>=1 && i<4)
   x=x+1;
else if (i==6||i==8)
   x=x+2;
else
   x=x+3;
``` | ```
switch(i){
    case 1:
    case 2:
    case 3:
            x=x+1;
            break;
    case 6:
    case 8:
            x=x+2;
            break;
    default:
            x=x+3;
}
``` |

Question 3 (9+6 pints):

Determine the output of each of the following programs for each of the input values entered by the user (when applicable):

(i)

```
#include <stdio.h>

int main(void)
{
   int a, b, c;
   scanf ("%d %d %d",&a , &b, &c);
   if (a<=b<=c)
     printf ("%d is in between %d and %d\n", b, a, c);
   if (b < a)
     printf ("%d is less than %d\n", b, a);
   if (b > c)
     printf ("%d is greater than %d\n", b, c);

     return 0;
}
```

User Input	Program Output
-2 -1 -1	
5 2 8	**2 is in between 5 and 8** **2 is less than 5**
5 8 2	**8 is in between 5 and 2** **8 is greater than 2**

(ii)   In grid below, assume that each square represents a space and each row represents a line on the screen. Then show how the output of the following program will be displayed.

```
#include <stdio.h>
int main(void) {
     double i=99.869;
     int j=-124;
     printf("%6.0f%8d\n",i,j);
     printf("%5.1f%9.5f\n",i,i);
     return 0;
}
```

			1	0	0				−	1	2	4					
9	9	.	9		9	9	.	8	6	9	0	0					

Question 4 (7 + 10 points):

i)   Assume that a student grade is stored in a variable called percent_grade which is a valid percentage (i.e. its value is from zero up to 100), Write a code fragment that converts a student grade to a letter grade as per the table given below. Also make sure not to test a condition more than once.

Percentage	Letter Grade
> 90	A
>80 and <=90	B
>70 and <=80	C
>60 and <=70	D
<=60	F

```
if(percent_grade>90)
    grade='A';
else if(percent_grade>80)
    grade='B';
else if(percent_grade>70)
    grade='C';
else if(percent_grade>60)
    grade='D';
else
    grade='F';
```

ii)   Assume you have read three numbers and stored them in variables a, b, c; write a code fragment that checks whether these numbers can be sides of a triangle. Hint: if the sum of the two minimum numbers is greater than the third, then they can be sides of a triangle.

```
// One approach is as follows but there are several others
if(a+b>c&& a+c>b&&c+b>a)
    printf("form a triangle");
else
    printf("cant not form a triangle");
```

Question 5 (22 points):

Write a C program that asks the user to enter an arithmetic equation (+, -, *. /) with two real numbers and prints the equation with numbers and the result rounded to two decimal places. If an incorrect operation is entered, the program should display the message "Invalid operation entered …".

A sample execution of the program is shown below:

```
Enter an arithmetic equation (+,-,*,/) with two real numbers: 5.2 - 3.9
5.20 - 3.90 = 1.30
Press any key to continue . . . _
```

```
Enter an arithmetic equation (+,-,*,/) with two real numbers: 2.5 * 3
2.50 * 3.00 = 7.50
Press any key to continue . . .
```

```
Enter an arithmetic equation (+,-,*,/) with two real numbers: 5 % 2
Inavlid operation entered ...
Press any key to continue . . . _
```

```c
#include <stdio.h>
#include <stdlib.h>

int main(void)
{
   double x, y, z;
   char op, v;

      printf("Enter an arithmetic equation (+,-,*,/) with two real numbers: ");
   scanf("%lf %c %lf",&x, &op, &y);
   v = 1;
   switch(op){
   case '+': z = x + y; break;
   case '-': z = x - y; break;
   case '*': z = x * y; break;
   case '/': z = x / y; break;
   default:
        v=0; printf("Inavlid operation entered ...\n");
   }

   if (v) printf("%.2f %c %.2f = %.2f\n", x, op, y, z);

   system("pause");

   return 0;
}
```

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