

**Information and Computer Science Department**

**Spring Semester 132**

**ICS 103 – Computer Programming in C**

**Midterm Exam key**

**Thursday, April 03, 2014**

**Duration: 120 minutes**

|  |  |
| --- | --- |
| **Name:** |  |

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| **Section#:** |  |

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| **Instructor:** |  |

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| **Question #** | **Maximum** **Grade** | **Obtained** **Grade** |
| **1** | 4 |  |
| **2** | 12 |  |
| **3** | 36 |  |
| **4** | 15 |  |
| **5** | 10 |  |
| **6** | 8 |  |
| **7** | 15 |  |
| **Total** | **100** |  |

**Question # 1 [4 points]**

Fill in the circles with the software used in developing a high-level language program:



**Question # 2 [12 points]**

Apply the software development method to find the volume and surface area of a sphere given its radius.

$volume=\frac{4}{3}πr^{3}$ $surface area=4πr^{2}$ , where r is the radius and π=3.14159

Note: Apply the first four steps ending with a complete C program.

**Problem**:

Find the volume and surface area of a sphere given its radius.

**Analysis**:

Problem Constant

PI 3.14159

Problem Input

double radius

Problem Output

double volume, surface\_area

Relevant Formula

$volume=\frac{4}{3}πr^{3}$ $surface area=4πr^{2}$ , where r is the radius and π=3.14159

**Design**:

Algorithm

1. Get the radius
2. Compute the volume
	1. Assign 4/3 \* PI \* radius ^ 3 to the volume
3. Compute the surface area
	1. Assign 4 \* PI \* radius ^ 2 to the surface area
4. Display the volume and the surface area

**Implementation**:

**/\* Calculating the Volume and the Surface Area of a Sphere \*/**

**#include <stdio.h>**

**#define PI 3.14159**

**int main(void)**

**{**

 **double radius; /\* input - radius of a sphere \*/**

 **double volume; /\* output - volume \*/**

 **double surface\_area; /\* output - surface area \*/**

 **/\* Get the radius \*/**

 **printf("Enter radius> ");**

 **scanf("%lf", &radius);**

 **/\* Calculate the volume \*/**

 **volume = 4.0 / 3.0 \* PI \* radius \* radius \* radius;**

 **/\* Calculate the surface area \*/**

 **surface\_area = 4 \* PI \* radius \* radius;**

 **/\* Display the volume and surface area \*/**

 **printf("The volume is %.2f\n", volume);**

 **printf("The surface\_area is %.2f\n", surface\_area);**

 **return (0);**

**}**

**Question # 3 [36 points]**

Identify the error(s), if any, in each of the following code fragments. If a fragment has no errors, write its output. [Note: No explanation of error(s) is required].

| **Code Fragment** | **Output** |
| --- | --- |
| int x = 3;x = x \* x – x / x;printf("%d", x); | 1 mark8 |
| int a, b, c, x;x = 1;a = 77;b = 10;c = 11;x = a % b;printf("%d ", x);x = a / b;printf("%d ", x);x = b % a;printf("%d ", x);x = b / a;printf("%d ", x); | 4 marks7 7 10 0 |
| double x=1234.5678;int y=77; printf("%.1f%d\n", x, y);printf("%1.1f%2d\n", x, y);printf("%4.2f%3d\n", x, y);printf("%7.3f%4d\n", x, y);printf("%9.3f%4d\n", x, y); | 5 marks

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | . | 6 | 7 | 7 |  |  |  |  |  |  |  |
| 1 | 2 | 3 | 4 | . | 6 | 7 | 7 |  |  |  |  |  |  |  |
| 1 | 2 | 3 | 4 | . | 5 | 7 |  | 7 | 7 |  |  |  |  |  |
| 1 | 2 | 3 | 4 | . | 5 | 6 | 8 |  |  | 7 | 7 |  |  |  |
|  | 1 | 2 | 3 | 4 | . | 5 | 6 | 8 |  |  | 7 | 7 |  |  |

 |
| double x = 10.4, y; int m = 2 , n = 7 ;y = x / m;printf("%.1f\n", y);y = n / m;printf("%.1f\n", y); | 2 marks5.23.0 |
| int x = 12;if(x > 5) printf("A");if(x > 6) printf("B");if(x > 12) printf("C");else if(x > 8) printf("D");else if(x > 4) printf("E");else printf("F"); | 3 marksABD |
| int x = 10;if (x > 15) x = 0; printf(“%d”, x);else printf(“%d”, x + 5); | 2 marksElse without if |
| int x;scanf(“%d”, &x);switch(x){case 1: x = x + 1; break;case 3: x = x + 2;case 5: if(x == 4) x = x + 6;case 6: x = x + 3; break;default: x = x – 1;}printf(“%d”, x); | 3 marks When x is 12When x is 21When x is 38 |
| int i, j;i = 3;while (i < 7){ for(j = 5; j >= i; j = j-2) { printf("%d ", i + j); } printf("\n"); i = i + 3;}printf("%d %d\n", i, j); | 4 marks8 69 5 |
| int i,j,count = 0; for(i = 3; i != 5; i +=2)  for(j = 3; j > i; j = j-2)  count++;printf("%d %d %d\n", i, j,count); | 3 marks5 3 0 |
| int i, j;for (i = 1; i <= 5; i++){ for (j = 1; j <= i; j++) printf("%d",j); for (j = i; j <= 5; j++) printf("%d",j); printf("\n");} | 5 marks112345122345123345123445123455 |
| #include <stdio.h>int f1(int x);int main(){ int k = 1,m = 6; printf("%d %d \n",f1(k),f1(m)); return 0;}int f1(int x){ if (x <= 2) return 2; else return 2\*(x-1);} | 4 marks2 10 |

**Question # 4 [15 points]**

In each semester, a private University charges 2000 Saudi Riyals per course for each of the first four courses a student takes. For each course in excess of 4, the charge is 1500 per course. Write a C program that prompts for and reads the number of courses a student takes in a semester; it then displays the total charge to be paid. Your program must display an appropriate error message if the entered number of courses is zero or negative.

Sample program runs:

|  |
| --- |
| 01.jpg |
| 2.jpg |

Note: Your program must be general and not specific to the given sample runs.

**#include <stdio.h>**

**#define CHARGE1 2000**

**#define CHARGE2 1500**

**int main(void){**

 **int numCourses, charge;**

 **printf("Enter number of courses: ");**

 **scanf("%d", &numCourses);**

 **if(numCourses <= 0)**

 **printf("Error: Invalid number of courses\n");**

 **else{**

 **if(numCourses <= 4)**

 **charge = numCourses \* CHARGE1;**

 **else**

 **charge = 4 \* CHARGE1 + (numCourses - 4)\*CHARGE2;**

 **printf("Total charge = %d Saudi Riyals\n", charge) ;**

 **}**

 **return 0;**

**}**

**Question # 5 [10 points]**

Write a C program that asks the user to enter an integer number n and displays the multiplication table for numbers 1 to n. Display each number in 3 places. The output of your program should be as follows for n = 5:



**#include <stdio.h>**

**int main ()**

**{**

 **int n, i, j;**

 **printf("Enter a number: ");**

 **scanf("%d", &n);**

 **printf(" ");**

 **for (i = 1; i <= n; i++)**

 **printf("%3d",i);**

 **printf("\n");**

 **for (i = 1; i <= n; i++){**

 **printf("%3d", i);**

 **for (j = 1; j <= n; j++)**

 **printf("%3d", i\*j);**

 **printf("\n");**

 **}**

 **return 0;**

**}**

**Question # 6 [8 points]**

Write a C program that computes the following sum based on the value of x input by the user.

$$sum=\sum\_{1=1}^{i=10}\frac{x^{i}}{2i-1}$$



**#include <stdio.h>**

**#include <math.h>**

**int main(){**

 **double x, sum, i;**

 **sum = 0;**

 **printf("Enter value of x >");**

 **scanf("%lf", &x);**

 **for(i = 1; i <= 10; i = i + 1)**

 **sum = sum + pow(x, i) / (2 \* i - 1);**

 **printf("sum =%.2f\n", sum);**

 **return 0;**

**}**

**Question # 7 [15 points]**

The body mass index **(BMI)** is a measure for human body shape based on an individual's weight and height. It is a simple method to assess how much an individual's body weight departs from what is normal. It can be measure by the formula:

**BMI = (weight in kg) / (heightin m)2**

Depending on the value of BMI, a person can be categorized in different weight ranges as given in the table below.

|  |  |
| --- | --- |
| **BMI (kg/m2)** | **Weight Range** |
| Less than 18.5 | Underweight |
| From 18.5 to 24.9 | Normal |
| From 25 to 29.9 | Overweight |
| 30 and more | Obese |

Write a complete C language program using a function **bmi\_calc** to calculate BMI. Ask the user about height and weight in the main function. Print a message to the user showing him weight in kg, height in m, BMI and the weight range category as shown in the image.

 

**#include <stdio.h>**

**double bmi\_calc (double weight, double height);**

**int main(){**

 **double w, h, bmi;**

 **/\* get the input weight from the user \*/**

 **printf("Enter your weight(in kg):");**

 **scanf("%lf", &w);**

 **/\* get the input height from the user \*/**

 **printf("Enter your height(in m):");**

 **scanf("%lf", &h);**

 **bmi = bmi\_calc (w, h);**

 **/\* print the result \*/**

 **printf("\nYour Weight: %.2fkg, Your Height: %.2fm, BMI: %.2f\n\n", w, h, bmi);**

 **if (bmi < 18.5)**

 **printf("Category: Underweight\n\n");**

 **else if (bmi < 25)**

 **printf("Category: Normal\n\n");**

 **else if (bmi < 30)**

 **printf("Category: Overweight\n\n");**

 **else**

 **printf("Category: Obese\n\n");**

 **return 0;**

 **}**

**double bmi\_calc (double weight, double height){**

 **/\* bmi calculation \*/**

 **return (weight)/(height \* height);**

**}**