EXAMINATION COVERSHEET

Autumn 2023 Midterm Examination

UNIVERSITY
OF WOLLONGONG
IN DUBAI

THIS EXAMINATION CONTENT IS STRICTLY CONFIDENTIAL

Students must comply with requirements stated in the Examination Policy & Procedures

Student Number:	
First Name:	
Family Name:	
Date of Examination: (DD/MM/YY)	**05/11/2023**
Subject Code:	**CSCI291**
Subject Title:	**Programming for Engineers**
Time Permitted to Write Exam:	**2 Hours**
Total Number of Questions:	**4**
Total Number of Pages *(including this page):*	**5**

INSTRUCTIONS TO STUDENTS FOR THE EXAM

1. Read fully the question before start answering it.
2. Answers must be written (and drawn) in black or blue ink.
3. Any mistakes must be crossed out. Whitener and ink erasers must not be used.
4. Answer **ALL** questions. The marks for each question are shown next to each question.
5. Total marks: **50**. This Exam is worth 20% of your final marks for CSCI291.

EXAMINATION MATERIALS/AIDS ALLOWED
Appendix and approved calculator

Exam Unauthorised Items - Students bringing these items to the examination room must follow the instructions of the invigilators with regards to these items.

1. Bags, including carrier bags, backpacks, shoulder bags and briefcases
2. Any form of electronic device including but not limited to mobile phones, smart watches, MP3 players, handheld computers and unauthorised calculators.
3. Calculator cases and covers, opaque pencil cases
4. Blank paper
5. Any written material

NOTE: The University does not guarantee the safe-keeping of students' personal items during examinations. Students concerned about the safety of their valuable items should make alternative arrangements for their care.

Question 1 (6 marks)

The following C program aims to increment the value of the integer variable `x` with the constant `BIAS` using the function `bias_number`. The resulting value is printed on the screen. Fix all the logical and syntax errors in the program (11 errors or more).

```
#include<stdio.h>
void bias_number(int, int)
#define BIAS=10
int Main(void){
int x;
scanf("%f",x)
bias_number(x,BIAS);
printf("The biased value of x is %d", x);
}
void bias_number(int x, int shift){
int x;
x=x+shift;
}
```

[6 marks]

Question 2 (16.5 marks)

a) Write a C conditional expression comprising the variables `a`, `b`, `c`, and `x` so that the expression is only `true` if **any** of the following conditions is `true`:

- `x` is different of `c`
- `x` is strictly higher than `a` and less or equal `b`

[1.5 marks]

b) Give the value of the variable `res` after each of following statements execution:

- int a=3; int res=(a++ +1)*10;
- int a=18; float res = a/4;
- int a=18; float res = a/4.0;
- if(-1) res=10; else res = 7;

Explain your answers.

[3 marks]

c) Convert the pre-test *for* loop code given below into a,

i) Pre-test **while loop** code

ii) Post-test **do...while** code

```
int data=-1;
for (int i=0; i<10; i+=2){
   scanf("%d", &data);
   print("%d\n", data);
}
```

[3 marks]

d) What are the printed values from the below program execution? Explain your answer.

```
int main()
{
    int a=3;
    modifyValue(a);
    printf("a=%d \n", a);

    for(int i=2; i<1; i++)
        printf("i=%d", i);

    return 0;
}

void modifyValue(int a) {
    a = a + 10;
}
```

[2.5 marks]

e) Give the output of each of the following code segments if it does compile. If it does not, explain why.

- ```
  for(int i=0;i<3;i++){
      if(i==1) continue;
      printf("%d \n", i);
  }
  ```
- ```
  int main(){
  for(int i=0; i<3;i++);
  printf("%d",i);
  }
  ```

[2 marks]

f) **Using a C switch case block and NOT an IF statement**, write the C code of the function:

```
int calculator(char operator, int operand1, int operand2)
```

The function returns,

- the addition of `operand1` and `operand2` when operator equals the character `+`

- the subtraction of `operand1` from `operand2` when operator equals the character `-`
- the multiplication of `operand1` and `operand2` when operator equals the character `*`

For any other character value of the `operator`, a relevant error message should be displayed before exiting the function.

[3.5 marks]

g) Convert the following code to a conditional expression using the C ternary conditional operator (?:)

```
if(i==1) res=4; else res = 3;
```

[1 mark]

Question 3 (19 marks)

Write a full C program comprising the following three functions:

a) …read_pos_validation(): to return a positive integer value, input by the user. The function should keep prompting the user to input a positive integer value until (s)he does so. **The code should cater for non-integer user input.**

[7 marks]

b) **… Is_prime(int a):** to return `true` if the parameter `a` is a **prime number**; otherwise, the function returns `false` according to the following algorithm:

> Initialise a Boolean variable `isPrime` to `true` (indicating that `a` is assumed to be prime).
> If `a` is less than 2, set `isPrime` to `false`
> `Else` check if `a` is divisible by any value between 2 to the square root of `a` (inclusive).
> If it is divisible, set `isPrime` to `false` and break out of the loop (`a` is not prime)
> return `isPrime`.

[8 marks]

c) **main()** whereby,

- The function **read_pos_validation** is called; the return value should be assigned to an integer variable `number`.
- Use the function **is_prime** to check if `number` is a prime number and print a corresponding **message accordingly.**

[4 marks including the rest of the program section]

Hint: you can use the following function for data validation:

```
void skip_line(){
  #define LINE_SIZE 100
  char line [LINE_SIZE];
  scanf("%[^\n]s", line);}
```

Question 4 (8.5 marks)

Write the code of the C function: **display_pattern**(int **depth**, int **nrows**) to display *the isosceles right triangles* pattern shown in Figure 1 (an isosceles right triangle is defined as a right-angled triangle with an equal base and height). Note that figure 1 gives an example of the displayed pattern when depth = 4 and nrows = 6. Your code should not be hard-coded for these two particular values*; it should rather work for any values of the function arguments: depth and nrows.*

The pattern consists of **nrows** lines. At each line of the pattern the following number of stars (`num_stars`) is printed, right-aligned, whereby,

i) `num_stars` = 1 at the top of each isosceles right triangle in the pattern

ii) At each new line of the pattern, `num_stars` is first **incremented**. If the resulting value is higher than `depth`**,** `num_stars` **is reset to 1**

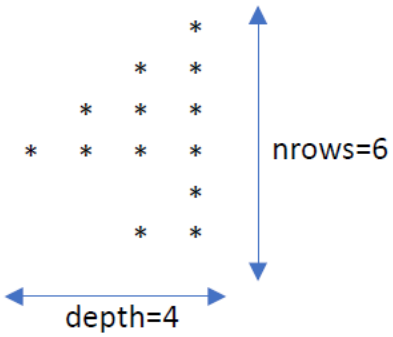

Figure 1: Example of display_pattern(int depth, int nrows) output when depth = 4 and nrows = 6

Hint: you can make use of the below function to right align the stars at each line

```
void add_blanks(int spaces){
   for(int i=0;i<spaces;i++)
     printf("%c", ' ');
}
```