KING SAUD UNIVERSITY
COLLEGE OF COMPUTER AND INFORMATION SCIENCES
COMPUTER SCIENCE DEPARTMENT

CSC215 - Procedural Programming
Semester 3: 2022-2023
Lab 02:Vars, data types and operators

Exercise 1: Defining constants and macros

1. Launch the terminal/commandline
2. Create a new directory with the name "Lab02" inside "CSC215"
3. Write the program "ex1.c" that:
   a. uses `#define` preprocessor to define a character constant that contains the horizontal tab character
   b. uses `const` keyword to define a string that contains CSC and an integer that contains 215
   c. prints CSC, then the horizontal tab character, then 215, all using the above mentioned constants.
4. Compile and run your program.   1 point

Exercise 2: Evaluating expressions

1. Write the program "ex2.c" that:
   a. declares three integer variables: a, b and c.
   b. initialize them to a = 1, b = 10, c = 0.
   c. prints the following output lines using the printf function:
   ```
   a=<a> b=<b> c=<c>
   a++ + <b> = <a++ + b>
   ++a + <b> = <++a + b>
   <a> && <c> = <a && c>
   <a> || <c> = <a || c>
   <a> & 2 = <a & 2>
   <a> | 0 = <a | 0>
   <a> << 2 = <a << 2>
   <a> >> 1 = <a >> 1>
   ```
   Note: `<expression>` here means value of `expression`.
   Example: to achieve the first line use the statement: `printf("a=%d b=%d c=%d\n", a, b, c);`
2. Compile and run your program.   1 point

Exercise 3: Reading, processing and displaying Results

1. Write the program "ex3.c" that:
   a. declares a constant π = 3.14
   b. reads the radius and the color of a circle
   c. calculates the area of this circle
   d. prints the color and the area in the format shown in the sample run.

   ```
   Enter the circle radius > 12
   Enter the circle color > Red
   The Red circle area = 452.16
   ```

   Note: The circle area formula is: $\pi \times r^2$, where r is the radius of the circle
2. Compile and run the program.   1 point
3. The header file `math.h` defines the constant `M_PI`. Modify your program to calculate the area using this constant.
4. Recompile <u>without -ansi</u> and run your program and note the difference.   1 point

Exercise 4: Formatting output using printf

1. Write the program "ex4.c" that prints the following values in the indicated formats:

<22/7>	as a float number
<22/7>	as a float with 10 decimal digits
<22/7>	as a float of length 20 with 10 decimal digits
<22/7>	as a float of length 20 with 10 decimal digits and leading 0s
<22/7>	as a float with 10 decimal digits and display the sign
<22/7>	as a float with 10 decimal digits as a percentage
<22/7>	as a float in the scientific notation
31567	in the hexadecimal system
"Good morning"	the first 4 characters of the string
"Good morning"	the first 4 characters of the string reserving a length of 10

2. Compile and run your program.   1 point

Optional Exercise 5: Setting and masking bit fields using bitwise operators

A smart home controller of the master bedroom interprets an 8-bit command as follows:

7 6 5 4 3 2 1 0
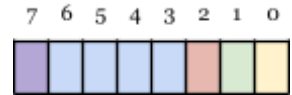
Bit 0   controls the lights: 0 means the light is off, 1 means the light is on

Bit 1   controls the curtains: 0 means the curtains are down, 1 means the curtains are up

Bit 2   controls the TV: 0 means the TV is off, 1 means the TV is on

Bits 3 to 6 controls the AC unit: there are 16 levels of temperature coded by values 0 to 15

Bit 7   controls the time alarm: 0 means the alarm is on, 1 means the alarm is off.

For example: - to open the curtains the controller uses: `flags |= 1 << 1;`

- to set the AC to level 6 the controller uses: `flags &=~ (15<<3); flags |=6<<3;`

- to set the time alarm on, the controller uses: `flags |= 1<<7;`

- to check the AC level, the controller uses: `flags >>3 & 15`

- to check the status of the TV, the controller uses: `flags >>2 & 1`

1. Write the program "ex5.c" that defines a variable `flags` of size 1 byte that represents smart home control command, and initializes it to 89, then:
   a. Print out the current status of the lights, the curtains, and level of AC
   b. Turn the TV on and set the AC to 12
2. Compile and run your program.

Lab assignment: 4 points

Write a C program assignment.c that prints the powers of the integer variables a = 1, b = 2 and c = 3 in a tabular format as below:

Expected output:

```
::::: Powers Table :::::
Number      Square      Cube        4th power
1           1           1           1
2           4           8           16
3           9           27          81
```