

This file contains all the questions solved.

1. Trace the evaluation of the following expressions, and give their resulting values, (**Please Submit Q1 in hand-written form to the TAs**).

A. Trace the evaluation of the following expressions, and give their resulting values (Note that all the constants of `int` type):

- $2 + 3 * 4 - 6$
- $12 - 2 - 3$
- $14 / 7 * 2 + 30 / 5 + 1$
- $6/2 + 7/3$
- $(12 + 3) / 4 * 2$
- $6 * 7 \% 4$
- $(238 \% 10 + 3) \% 7$
- $3 * 4 + 2 * 3$
- 113
- $(18 - 7) * (43 \% 10)$
- $2 + 19 \% 5 - (11 * (5 / 2))$
- $813 \% 100/3 + 2.4$
- $26 \% 10 \% 4 * 3$
- $22 + 4 * 2$
- $23 \% 8 \% 3$
- $177 \% 100 \% 10/2$
- $89 \% (5 + 5) \% 5$
- $392/10 \% 10/2$
- $8 * 2 - 7/4$
- $37 \% 20 \% 3 * 4$

B. Trace the evaluation of the following expressions, and give their resulting values (Note that all the expression contains mixture of `int` and `float` constants):

- $17 \% 10/4$
- $(2.5 + 3.5)/2$
- $4.0/2 * 9/2$
- $9/4 * 2.0 - 5/4$
- $2.5 * 2 + 8/5.0 + 10/3$
- $9/2.0 + 7/3 - 3.0/2$
- $12/7 * 4.4 * 2/4$
- $813 \% 100/3 + 2.4$
- $4 * 3/8 + 2.5 * 2$
- $27/2/2.0 * (4.3 + 1.7) - 8/3$
- $(5 * 7.0/2 - 2.5)/5 * 2$
- $4.0/2 * 9/2$
- $12/7 * 4.4 * 2/4$
- $53/5/(0.6 + 1.4)/2 + 13/2$
- $41 \% 7 * 3/5 + 5/2 * 2.5$
- $2.5 * 2 + 8/5.0 + 10/3$
- $10.0/2/4$
- $2 * 3/4 * 2/4.0 + 4.5 - 1$
- $8/5 + 13/2/3.0$

● $89 \% 10/4 * 2.0/5 + (1.5 ++ 1.0/2) * 2$

2. Complete the code for the following for loop:

```
for (int i = 1; i < 6; i++) {
    // your code here
}
```

so that it prints the following numbers, one per line:

```
-4
14
32
50
68
86
```

3. Write a program that produces the following output. Use nested while loops to capture the structure of the figure.

```
!!!!!!!!!!!!!!!!!!!!
\\!!!!!!!!!!!!!!!!!!//
\\\\\\!!!!!!!!!!!!!!!///
\\\\\\\\\\!!!!!!!!!!!!/////
\\\\\\\\\\\\\\!!!!!!!!!!/////
\\\\\\\\\\\\\\\\\\!!!!!!/////
\\\\\\\\\\\\\\\\\\\\!!/////
```

4. In physics, a common useful equation for finding the position s of a body in linear motion at a given time t , based on its initial position s_0 , initial velocity v_0 , and rate of acceleration a is the following:

$$s = s_0 + v_0 t + 0.5 * a * t^2$$

Write code to declare variables for s_0 , v_0 , a , and t , and then write the code to compute s based on these values.

5. Write a while loop that produces the following output:

```
1 4 9 16 25 36 49 64 81 100
```

6. Write for loops to produce the following output:

```
1
2
3
4
5
```

7. Write while loops to produce the following output:

```
1
22
333
4444
55555
```

8. Write for loops to produce the following output, with each line 40 characters wide:

```

-----
_ ^ _ _ ^ _ _ ^ _ _ ^ _ _ ^ _ _ ^ _ _ ^ _
1122334455667788990011223344556677889900
-----

```

9. It's common to print a rotating, increasing list of single-digit numbers at the start of a program's output as a visual guide to number the columns of the output to follow. With this in mind, write nested while loops to produce the following output, with each line 60 characters wide:

```

          |           |           |           |           |
12345678901234567890123456789012345678901234567890

```

10. Write a program that produces the following output (with for loops):

```

***** ////////////// *****
***** //////////////\ *****
**** //////////////\ ****
*** //////////////\ ***
** //////////////\ **
* //////////////\ *
\ \ \ \ \ \ \ \ \ \

```

11. Write a program that produces the following output (with for loops, **Remember Divide and Conquer**):

```

+-----+
|   ^ ^   |
|  ^  ^  |
| ^    ^  |
|   ^ ^   |
|  ^  ^  |
| ^    ^  |
+-----+
| v    v  |
| v  v  |
|  vv  |
| v    v  |
| v  v  |
|  vv  |
+-----+

```

12. Write a program that produces the following output (with loops):

```

+-----+
|      *      |
|     /*\     |
|    /**\    |
|   /**\*\\   |
|  /**\*\\*\\  |
| \\*\*\\*\\*  |
|  \\*\*\\*\\  |
|   \\*\*\\*\\  |
|    \\*\*\\*\\  |
|     /*\     |
|      *      |
+-----+
|  \\*\*\\*\\*  |
|   \\*\*\\*\\  |
|    \\*\*\\*\\  |
|     *        |
|     *        |
|    /*\       |
|   /**\      |
|  /**\*\\*\\  |
+-----+

```

13. Write a program that produces the following output (do while loops):

```

-----1-----
----333-----
---55555---
--7777777--
-999999999-

```

14. Write a program that produces the following output (for loops):

```

+===+===+
|    |    |
|    |    |
|    |    |
+===+===+
|    |    |
|    |    |
|    |    |
+===+===+

```

15. Write code to find the minimum point of following function. *[Hint: Evaluate the function for a large domain of x and y values and find the values where minimum value occur].*

$$f(x, y) = (1 - x)^2 + 100(y - x^2)^2$$

16. Print the first 20 numbers of the series 4, 1, 16, 9, 36, 25, 64, 49, 100, 81....

17. Birth Date Application: Now write a C++ program that allows the user to enter two names. For each name, enter a 6-digit integer representing the person's age in years, months and days. For example, Asim's age is 14 years, 10 months and 7 days. In this case, his age should be entered as 141007(YYMMDD).

Your program should then separate each 6-digit number into three separate numbers to represent the **days, months, and years** [Hint: Use the % and / (integer division) operators] and print out both names, each followed by their ages written in the following standard format **DD/MM/YY**.

For example:

- Asim's age is 7/10/14 .
- Asad's age is 15/8/7.

Next your program should determine who is the oldest by testing the age and then should print out his/her name as follows:

- Asim is older than Asad!

If the two people have the same age, then the message should be : Asim and Asad are the same age!

18. Guess the Number Game: Now write a program that will ask the user to guess a secret number selected randomly by your program in 3 trials. After each trial, you should inform the user if she didn't guess correctly, the number trials remaining, and inform the user that she lost or won the game (when she guessed correctly.)

When game is over, ask the user to play again: If the user types "yes", have the game start again. If the user types "no", then stop playing the game. [Hint: You can use `rand()` function to get a random number in the range of $[0, 32767]$, you can use the % operator with number X to get an integer random number in the range $[0, X]$, i.e.

```
#include<cstdlib>
int main()
{
    /* generate secret number between 1 and 10: */
    int iSecret = rand() % 10 + 1;
}
```

19. Write a program that allows a user to convert positive numbers from binary (base 2) to decimal (Base 10). Use simple and accurate algorithm to produce the correct result. Here is an example of an algorithm illustrating how to convert from binary (base 2) to Decimal (base 10):

The binary or base-2 number 1 0 0 1 0 1 0 1 can be converted to a decimal number as follows:

$$\begin{aligned} 1*2^7 + 0*2^6 + 0*2^5 + 1*2^4 + 0*2^3 + 1*2^2 + 0*2^1 + 1*2^0 &= 128 + 16 + 4 + 1 \\ &= 149 \end{aligned}$$

The binary number 1 0 0 1 0 1 0 1 is written as 149 in the decimal system.