

Problems to solve (27) for practicing the control flow in preparation for the second In-class problem solving:

1. A test consists of 10 multiple choice questions, each of which has three possible answers. The first answer gets three points, the second one point, and the third two points. Write a program that uses the switch statement to read the test taker's 10 answers and display the final score.

2. What would be the output of the following program?

```
#include <stdio.h>
int main(void)
{
    int i, j;
    for(i = 10, j = 2; i != j; i-=2, j+=2)
        printf("%d %d\n", i, j);
    return 0; }
```

3. Write a program to read an integer in $[0, 100]$ and to display its factorial. The factorial of a positive integer n , where $n \geq 1$, is defined as $1 \times 2 \times 3 \times \dots \times n$, while the factorial of 0 equals 1 ($0! = 1$).

4. What is the output of the following program?

```
#include <stdio.h>
int main(void) {
    int n;
    for(n = 0; n ? 0 : n+1; n++)
        printf("%d\n", n);
    return 0; }
```

5. Write a program that reads an integer and displays its multiplication table. For example, if the user enters 5, the program should output: $1*5 = 5$, $2*5 = 10$, ..., $10*5 = 50$. The program should force the user to enter an integer within $[1, 10]$.

6. Write a program that reads a positive integer n and verifies the math formula:
 $1 + 3 + 5 + \dots + (2n-1) = n^2$.

7. Write a program to read the initial population of a country and its annual population growth (as a percentage). Then, the program is to read the number of years and display the new population for each year.

8. What is the output of the following program?

```
#include <stdio.h>
int main(void) {
    unsigned char i;
    for(i = 3; i && i-1; i--)
        printf("%d ", i);
    for(; ++i;)
        printf("\n%d ", i);
    return 0; }
```

9. Write a program to read two integers and displays the sum of the integers between them. For example, if the user enters 3 and 8, the program should display 22 because $4+5+6+7=22$. The program is to check which one of the two input numbers is the greater and act accordingly.
10. Write a program to read the grades of 100 students and to display the average of the passed students and the average of the failed students, before it ends. A student passes the exams with a grade equal to or greater than 5. The program is to ask the user to enter grades within [0, 10]. If the user enters -1, the insertion of grades should end.
11. Write a program that reads 8 bits (each bit is 0 or 1) and displays the corresponding unsigned integer, assuming that the bits are entered from left to right. For example, if the user enters 10000000 the program should display 128.
12. Write a program to display the sum of:
 $1 \times 23 \times 4 + 5 \times 67 \times 8 + 9 \times 1011 \times 12 + \dots$
until a term with value greater than 0.995 is going to be added. Also, the program is to display how many terms were added and the value of the last valid term.
13. What is the output of the following program? Remember that printf() returns the number of displayed characters.

```
#include <stdio.h>
int main(void) {
    int i;
    for(i = 0; printf("%d", i++) < 2;)
        ; //Empty loop
    printf("\nEnd = %d\n", i);
    return 0; }
```

14. Write a program that reads the number of students in a class and their grades on a test. The program should display the average test grade of the class, the minimum and maximum test grade, and how many students got the same maximum grade. Assume that the grades are integers within [0, 10].

15. Write a program that reads an integer and displays a message to indicate whether it is a prime number or not. It is reminded that a prime number is any integer greater than 1 with no divisor other than 1 and itself.
16. What is the output of the following program?

```
#include <stdio.h>
int main(void) {
    int i;
    for(i = 0; i < 2; i++)
    {
        printf("One ");
        for(i = 0; i < 2; i++)
            printf("Two ");
    }
    printf("The value is %d\n", i);
    return 0; }
```

17. Write a program that displays the multiplication table from 1 to 10.
18. Write C code that reads an integer that corresponds to a number of lines. The program should display in each line a number of '*' equal to the line number. For example, if the user enters 5 the program should display:

```
*
**
***
****
*****
```

19. Write a program that reads the grades of five students in three different courses and displays the average grade of each in the three courses, as well as the average grade of all students in all courses.
20. Write a program that displays the integer roots, if any, of the equation: $3x + 7y - 5z = 10$, where x, y, z are integers within $[-30, 30]$.
21. Write a program that reads integers continuously and displays them until the user enters 0. The number 0 must not be displayed.
22. Find the number of iterations in the following program.

```
#include <stdio.h>
int main(void) {
    int a = 256, b = 2;
```

```
while(a != b)
{
b = b*b;
a >>= 2;
}
return 0; }
```

23. Write a program to read an integer continuously and to display the word Greetings a number of times equal to the input integer. If the user enters a negative number, the insertion of integers should end and the program should display the total number of the displayed Greetings. Use only while loops.
24. Write a program to read the prices of a shop's products continuously until the user enters -1. The program is to display the lowest price, the highest, and the average of those prices within [5, 30], before it terminates. Assume that the highest price is \$100.
25. Write a program to read an integer and displays the number of its digits and their sum. For example, if the user enters 1234, the program is to display 4 and 10($1+2+3+4 = 10$).
26. Write a program to read an integer in [0, 255] continuously and to display it in binary. For example, if the user enters 32, the program is to display 00100000. For any value out of [0, 255] the program needs to terminate.
27. Write a program to read a positive integer and to display the largest positive integer n for which the sum $1^2 + 2^2 + 3^2 + \dots + n^2$ is less than the given number.