

## Microsoft .Net Framework and C# Programming Language

### Meeting №13

#### TOPIC: C# PROGRAMMING LANGUAGE

**Learning objective:** Acquire practical skills and theoretical knowledge on programming in C#. Learn to use the principles of object-oriented programming.

**Tools needed:** MS Visual Studio 2022

**Sources:** Lecture notes and literature

**Estimated time:** 5 hours.

#### Task 1

**The “Airplane pilot simulator” program.** Write a program called “Airplane pilot simulator”. The purpose of this application is to train novice pilots. The “Airplane” class should be implemented in the application (only one airplane object is used when training airplane pilots). The plane can change its speed and height.

**The speed can be changed with the Left and Right arrow keys:**

(Right: + 50km/h, Left: -50km/h, Shift- Right : +150km/h, Shift-Left: -150km/h).

**The altitude can be changed with the Up and Down arrow keys:**

(Up: +250m, Down: -250m, Shift- Up: +500m, Shift- Down: -500m).

The airplane can fly when it is controlled by at least two air traffic controllers. For this purpose, the application should have the “Controller” class. Before the flight has begun, the pilot should enter dispatchers who should monitor his flight (The flight cannot begin if it is less than two controllers). Each controller has a name (that is entered from the keyboard and is passed to a constructor when creating the “Con-

troller” object), and the so-called “weather condition adjustment”. Let’s assume that the controllers are located in different cities with the different weather, and this weather affects the ratio of speed and altitude of the aircraft flight. The adjustment should be generated randomly (See. below). All the controller objects should be placed in the appropriate member collection of the “Airplane” class.

The task of the pilot is to take off, gain the maximum speed (1000 km/h), and then land the aircraft. During the flight, the aircraft object automatically notifies all the controller objects about all the changes in speed and altitude using delegates. After receiving information on the current speed and altitude of the airplane, air traffic controller displays information about the recommended altitude. Recommended altitude calculated by the following formula:

$$Hr = 7 * Speed(km/h) - N,$$

where N is the “weather condition adjustment”. The “weather condition adjustment” value is generated randomly one time for each controller when creating an object. The value of N is chosen in the range of -200 to +200 meters. The process of controlling the aircraft by the controllers begins (ends) when the aircraft gains (loses) the speed of 50 km/h. The charts of recommended height and speed change are shown in Figure 1.

**Each controller charges penalty points when finds the difference between the recommended aircraft altitude and the current value:**

- If the difference is in the range of 300 to 600, the pilot receives 25 penalty points, and if the difference is in the range of 600 to 1000, he receives 50 points.
- If the difference is greater than 1000, the controller object throws the “Plane crash” exception, which should be handled by the application as the end of a training flight with the relevant information on the screen.
- If the pilot receives 1000 penalty points from any controller

before the end of the flight, then this controller object throws the “Unfit for flight” exception, which is also handled by the application.

- It is also unacceptable when the aircraft has a zero altitude and speed (if it did happen, then the controller throws the “Plane crash” exception). Except before taking off and after landing (the altitude and speed are equal to zero).
- If you try to exceed the maximum speed, the controller charges you by 100 penalty points and demands to reduce the speed immediately.

During the flight of the aircraft, the pilot can add more controllers, or remove the existing from the collection of air traffic controllers that control the flight. To do this, you should provide the appropriate menu items, as well as the preservation of penalty points that have been charged by the removed controller. *(At the same time, do not forget that the aircraft should be controlled by at least two controllers).*

When the aircraft has been successfully landed, the application sums all the penalty points from all of the controllers in the collection and displays the total sum on the screen. All the aircraft control commands, as well as the current flight characteristics and controller recommendations should be displayed on the screen. The result of the solution.

