UNIVERSITY OF PARMA

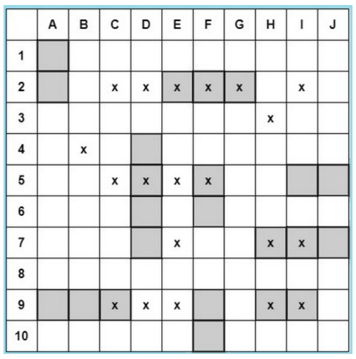
Department of Engineering and Architecture
Degree course in Computer, Electronic and Communications Engineering

PRACTICAL TEST IN COMPUTER SCIENCE & PROGRAMMING LABORATORY

September 17th , 2024

Name: ___________________ Surname:_________________ Matr:_______ Workstation: ________

Write a program using the C language (name the project with your student <**ID**>) that behaves as described below. The available time is 120 minutes. At the end of the time, the saved files on **U:\** are going to be automatically collected. Additional documents, files… are available in **T:\Bertozzi**, it is recommended to use WordPad to read text files.



	A	B	C	D	E	F	G	H	I	J
1	▨									
2	▨		x	x	▨ x	▨ x	▨ x		x	
3								x		
4		x		▨						
5			x	▨ x	x	▨ x			▨	▨
6				▨		▨				
7				▨	x			▨ x	▨ x	▨
8										
9	▨	▨	▨ x	x	x	▨		▨ x	▨ x	
10						▨				

“Battleship” is a strategy game for two players based on an $n \times n$ grid, where the positions of several “ships” are marked. Each ship occupies a given number of cells either horizontally or vertically and cannot overlap with other ships. Each player, on their turn, must guess the positions of the opponent's ships by indicating the coordinates (a letter for the rows and a number for the columns) where to fire a shot. The game ends when one of the players manages to sink all of the opponent's ships.
The candidate should develop a C program that simulates this game, specifically:

1. Randomly generate a number n in the range [9,13] and initialize an appropriate structure to store the $n \times n$ grid where the ships are placed. This structure should be dynamically allocated.
2. Develop the function ***void place_ship(??, int l);*** which places a ship of length l randomly on the grid defined earlier, ensuring that it does not overlap with ships already placed.
3. Call the previously developed function to place: 1 ship that occupies 4 cells, 2 ships that occupy 3 cells, 3 ships that occupy 2 cells, and 4 ships that occupy a single cell.
4. Develop the function ***int shoot(??, int c, int r);*** which “fires” a shot at the cell with coordinates (c, r). This function, besides modifying the data structure defined in point #1, returns 0 if no ships are hit, and 1 if a ship is hit.
5. Print the current state of the game grid using an appropriate function.
6. Enter a loop where the user is repeatedly asked for a pair of coordinates, uses them to call the function defined in point #4, and then uses the function defined in point #5 to print the game state.
   It's not mandatory for the coordinates to be requested in the usual letter-number form.
7. The loop ends when all ships are hit in all their cells, i.e., when they are “sunk”.

The code should be developed following the proposed order. The correction stops at the first incorrectly implemented step.