12.1 - Battleship

Create a space themed single player variation of Battleship. This is a classic guessing game dating back to the 1930s in which players try to shoot enemy ships in a grid by guessing grid coordinates. The ships occupy groups cells of various shapes on the grid. After each guess, the program will indicate whether the shot was a hit or a miss. Once all of a ship's coordinates have been hit, the ship is destroyed. The goal is to locate and destroy each ship in a fleet of five ships with as few shots as possible. The fleet consists of a mothership that occupies 5 cells, a battleship that occupies 4 cells, a destroyer that occupies 3 cells, a stealth ship that occupies 3 cells, and a patrol ship that occupies 2 cells. The shapes of each ship can be seen in the examples below.

At the start of your program, the player should be presented with a main menu from which they can choose between; viewing the instructions, viewing an example map, starting a new game, viewing the hall of fame, or exiting the program. If the player enters an invalid choice, the program should display an appropriate error message and let the player try again until a valid selection is made. The program should only end if the player chooses to exit.

Choosing to view the instructions will display instructions and then return to the main menu. Choosing to view an example map will display a map grid with the ship locations marked and then return to the main menu. This map should be generated by your `make_grid` function, described below.

When starting a new game, the computer should call a function named `make_grid` to generate a randomized grid with the location of each ship. This function should take no arguments and return the grid as a list of 10 nested lists, with 12 elements each. The elements in the inner lists should be single character strings. For the locations of the ships, use 'M', 'B', 'D', 'S', and 'P' to represent the mothership, battleship, destroyer, stealth ship, and patrol ship, respectively. All the other elements should be '$\sim$' to represent empty space. No other portion of your program should involve random chance.

The grid is displayed to the user with rows labeled by numbers 0 through 9, and columns labeled by letters A through L. The location of the ships is masked such that initially, all the locations show empty space. In each round, the player will choose a target by entering the row number and column letter as a single string (e.g. '6g'). If the player enters an invalid target, the program should display an invalid input message and let the player try again without counting a shot. For valid targets, the program should tell the user whether the shot was a hit or a miss, and then the next round begins by displaying an updated grid with hits marked by 'x's and misses marked by 'o's before waiting for the next guess.

The game ends when the player successfully destroys all the ships. A final score is based on the player's accuracy and is determined by dividing the number of hits by the total number of shots taken. If the player quits before destroying all the ships, their score is not calculated. If their accuracy score is higher than the lowest score in the Hall of Fame or if there are fewer than 10 records in the Hall of Fame, the player's name and accuracy should be added at the appropriate position in the Hall of Fame. Then a message should be displayed that congratulates the player and shows the Hall of Fame as a table with columns for rank, player name, and accuracy. The table should be sorted from highest to lowest accuracy. If multiple players have the same accuracy, they should be listed in the order that their scores were achieved (i.e. the first player to achieve 50% should appear above any subsequent players who achieve 50%).

Once the game is complete, the program returns to the main menu.

From the main menu, the player can also choose to view the Hall of Fame. This option displays the same table presented to the user when they achieve a high score. Hall of fame records should be saved in a file named `battleship_hof.txt`. The first line in the file is a header with column labels. Each subsequent line in the file should contain one record formatted as the number of misses, followed by a comma, and then the name of a player. Only the top ten accuracy scores (hits divided by total shots) should be kept. The data from the file should be updated with any new high scores before your program ends.

Other than the function `make_grid` described above, you are free to design your program however you like. You may use object-oriented programming techniques, but are not required to do so.

Test your program thoroughly. Format your program to match the samples below. Your output should closely match the sample output, character for character, including all white space and punctuation. User input in the sample has been highlighted in Pappy's Purple to distinguish it from the program's output, but your user input does not need to be colored. Save your program as `battleship_login.py`, where `login` is your Purdue login, and then submit it. Screenshots are **not** required.

Terminal

```
$ python battleship_login.py
                  ~ Welcome to Battleship! ~

ChatGPT has gone rogue and commandeered a space strike fleet.
It's on a mission to take over the world.  We've located the
stolen ships, but we need your superior intelligence to help
destroy them before it's too late.

Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do? quit

Invalid selection.  Please choose a number from the menu.

Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do? #$%

Invalid selection.  Please choose a number from the menu.

Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do? 5

Goodbye
```

Note that incorrect input is handled by displaying an error message and then presenting the main menu again.

Terminal

```
Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do? 1

Instructions:

Ships are positioned at fixed locations in a 10-by-12 grid.  The
rows of the grid are labeled 0 through 9, and the columns are
labeled A through L.  Use menu option "2" to see an example.
Target the ships by entering the row and column of the location
you wish to shoot.  A ship is destroyed when all of the spaces
it fills have been hit.  Try to destroy the fleet with as few
shots as possible. The fleet consists of the following 5 ships:

Size : Type
   5 : Mothership
   4 : Battleship
   3 : Destroyer
   3 : Stealth Ship
   2 : Patrol Ship

Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do? 2
```

Note that the instructions do not need to exactly match the sample output.

Terminal

```
Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do? 2

   A  B  C  D  E  F  G  H  I  J  K  L
0  ~  ~  ~  ~  ~  ~  ~  ~  P  P  ~  ~
1  ~  S  S  S  ~  ~  ~  ~  ~  ~  ~  ~
2  ~  ~  ~  ~  ~  ~  ~  ~  ~  D  ~  ~
3  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  D  ~
4  ~  ~  ~  ~  ~  ~  ~  ~  ~  D  ~  ~
5  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
6  ~  B  B  ~  ~  ~  ~  ~  ~  M  ~  M
7  ~  B  B  ~  ~  ~  ~  ~  ~  ~  M  ~
8  ~  ~  ~  ~  ~  ~  ~  ~  ~  M  ~  M
9  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do?
```

Note the required shape of each ship. The ships may be rotated relative to the orientations shown here.

Terminal

```
Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do? 4

Hall of Fame:
+------+-------------+----------+
| Rank | Player Name | Accuracy |
+------+-------------+----------+
|   1  |   Terry J   |   65.38% |
|   2  |   Graham    |   56.67% |
|   3  |    Eric     |   45.95% |
|   4  |   Terry J   |   40.48% |
|   5  |   Terry J   |   34.00% |
|   6  |    Eric     |   32.08% |
|   7  |   Terry G   |   23.94% |
+------+-------------+----------+

Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do?
```

Note that the Hall of Fame can be less than 10 entries, but it cannot of more than 10 entries.

Terminal

```
Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do? 3

   A  B  C  D  E  F  G  H  I  J  K  L
0  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
1  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
2  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
3  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
4  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
5  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
6  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
7  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
8  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
9  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

Where should we target next (q to quit)?
```

Note that the grid is initially masked so that the player cannot see the location of any ships.

Terminal

```
Where should we target next (q to quit)? 4i

miss

   A  B  C  D  E  F  G  H  I  J  K  L
0  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
1  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
2  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
3  ~  ~  ~  ~  ~  ~  ~  o  ~  ~  ~  ~
4  ~  ~  ~  ~  ~  ~  ~  ~  o  ~  ~  ~
5  ~  ~  ~  ~  ~  o  ~  ~  ~  ~  ~  ~
6  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
7  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
8  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
9  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

Where should we target next (q to quit)? 6j

IT'S A HIT!

   A  B  C  D  E  F  G  H  I  J  K  L
0  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
1  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
2  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
3  ~  ~  ~  ~  ~  ~  ~  o  ~  ~  ~  ~
4  ~  ~  ~  ~  ~  ~  ~  ~  o  ~  ~  ~
5  ~  ~  ~  ~  ~  o  ~  ~  ~  ~  ~  ~
6  ~  ~  ~  ~  ~  ~  ~  ~  ~  x  ~  ~
7  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
8  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
9  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

Where should we target next (q to quit)?
```

Note that hits are marked by ‘x’s and misses are marked by ‘o’s.

Terminal

```
   A  B  C  D  E  F  G  H  I  J  K  L
0  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
1  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
2  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
3  ~  ~  ~  ~  ~  ~  ~  o  ~  ~  ~  ~
4  ~  ~  ~  ~  ~  ~  ~  ~  o  ~  ~  ~
5  ~  ~  ~  ~  ~  o  ~  ~  ~  ~  ~  ~
6  ~  ~  ~  ~  ~  ~  ~  ~  ~  x  ~  x
7  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  x  ~
8  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  x
9  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

Where should we target next (q to quit)? 8j

IT'S A HIT!
The enemy's Mothership has been destroyed.

   A  B  C  D  E  F  G  H  I  J  K  L
0  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
1  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
2  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
3  ~  ~  ~  ~  ~  ~  ~  o  ~  ~  ~  ~
4  ~  ~  ~  ~  ~  ~  ~  ~  o  ~  ~  ~
5  ~  ~  ~  ~  ~  o  ~  ~  ~  ~  ~  ~
6  ~  ~  ~  ~  ~  ~  ~  ~  ~  x  ~  x
7  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  x  ~
8  ~  ~  ~  ~  ~  ~  ~  ~  ~  x  ~  x
9  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

Where should we target next (q to quit)?
```

The program indicates which ship has been destroyed whenever a ship is destroyed.

Terminal

```
Where should we target next (q to quit)? spam
Please enter exactly two characters.
Where should we target next (q to quit)? k9
Please enter a location in the form "6G".
Where should we target next (q to quit)? 8b
Please enter a location in the form "6G".
Where should we target next (q to quit)?
```

Note that invalid guesses can occur any number of times and that they should not count towards the number of shots.

Terminal

```
Where should we target next (q to quit)? 8j

You've already targeted that location

   A  B  C  D  E  F  G  H  I  J  K  L
0  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
1  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
2  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
3  ~  ~  ~  ~  ~  ~  ~  o  ~  ~  ~  ~
4  ~  ~  ~  ~  ~  ~  ~  ~  o  ~  ~  ~
5  ~  ~  ~  ~  ~  o  ~  ~  ~  ~  ~  ~
6  ~  ~  ~  ~  ~  ~  ~  ~  ~  x  ~  x
7  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  x  ~
8  ~  ~  ~  ~  ~  ~  ~  ~  ~  x  ~  x
9  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

Where should we target next (q to quit)?
```

Repeated guesses are indicated, and **do** count toward the number of shots, but **do not** count toward the number of hits.

Terminal

```
   A  B  C  D  E  F  G  H  I  J  K  L
0  ~  ~  ~  ~  ~  ~  ~  o  x  ~  ~  ~
1  o  x  x  x  ~  ~  ~  ~  o  ~  ~  ~
2  ~  ~  ~  ~  ~  ~  ~  ~  ~  x  ~  o
3  ~  ~  ~  o  ~  ~  ~  o  ~  ~  x  o
4  ~  ~  ~  ~  ~  ~  ~  ~  o  x  ~  o
5  ~  ~  o  ~  ~  o  ~  ~  ~  ~  ~  ~
6  ~  x  x  ~  ~  ~  ~  ~  ~  x  ~  x
7  ~  x  x  ~  ~  ~  ~  o  ~  ~  x  ~
8  ~  ~  ~  o  ~  ~  ~  ~  ~  x  ~  x
9  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

Where should we target next (q to quit)? 0j

IT'S A HIT!
The enemy's Patrol Ship has been destroyed.

You've destroyed the enemy fleet!
Humanity has been saved from the threat of AI.

For now ...

Congratulations, you have achieved a targeting accuracy of
54.84% and earned a spot in the Hall of Fame.
Enter your name: John

Hall of Fame:
+------+-------------+----------+
| Rank | Player Name | Accuracy |
+------+-------------+----------+
|   1  |   Terry J   |   65.38% |
|   2  |   Graham    |   56.67% |
|   3  |    John     |   54.84% |
|   4  |    Eric     |   45.95% |
|   5  |   Terry J   |   34.00% |
|   6  |   Terry G   |   23.94% |
+------+-------------+----------+

Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do?
```

Note that the game ends after all five ships have been destroyed. If the player achieved a high score, they will enter their name and be added to the Hall of Fame. The Hall of Fame is persistent between games and program runs.

Terminal

```
   A  B  C  D  E  F  G  H  I  J  K  L
0  o  ~  o  o  o  ~  ~  ~  ~  x  o  ~
1  o  x  x  x  o  o  o  o  o  o  o  o
2  o  o  o  o  o  o  o  o  o  x  o  o
3  o  o  o  o  o  o  o  o  o  o  x  o
4  o  o  o  o  o  ~  o  ~  o  x  o  o
5  o  o  o  o  o  o  o  o  o  o  o  o
6  o  x  x  o  o  o  o  o  o  x  o  x
7  o  x  x  o  o  o  o  o  o  o  x  o
8  o  o  o  o  o  o  o  o  o  x  o  x
9  o  o  o  o  o  o  o  o  o  o  o  ~

Where should we target next (q to quit)? 0i

IT'S A HIT!
The enemy's Patrol Ship has been destroyed.

You've destroyed the enemy fleet!
Humanity has been saved from the threat of AI.

For now ...

Your targeting accuracy was 14.41%.

Menu:
  1 : Instructions
  2 : View Example Map
  3 : New Game
  4 : Hall of Fame
  5 : Quit
What would you like to do?
```

Note that if the player does not achieve a high enough accuracy to make it into the Hall of Fame, it is not shown when the game ends.