Note: Please focus on the main logic and main feature!
(Splash screen and design are not scored)

Soal
Case

C Space Invader

Space Invaders is a very simple game by modern standards, but it was a technological marvel in its time. Space Invaders was a worldwide success and paved the way for a generation of shooting games that became extremely popular.You as a developer asked to make a Space Invader with C Programming Languange.

➢ **Main menu**

- This menu contains of 5 menus, which are **New Game**, **Load Game**, **Setting, How to Play, and Exit.**

- **Prompt** user to **input chosen menu**. **Validate** the input must **between 1 and 5 inclusively**.

```
NEW GAME        <
LOAD GAME
SETTING
HOW TO PLAY
EXIT
```

Figure 1. Home Page

1. If user choose **New Game** (**Menu 1**), then:

   o **Prompt** user to **input username**. **Validate** the data must more than **3 characters exclusively**

   o Validate the **username** must **not exists** on **'database/player.dat'.**

```
Select Your New Name :
```

Figure 2. Input Username

```
Select Your New Name : tintin

Sorry but name already exists! [press enter]
```

Figure 3. Username Validation

o   **Direct** user to **game page.**

2. If user choose **Load Game (Menu 2)**, then:

o   **Show** all available player at **'player.dat'**

o   **Prompt** user to **input chosen menu**. **Validate** the input must between **1 and total player + back inclusively.**

o   If load data **success, direct** user to **game page**.

o   If user choose **back, direct** to **main menu**.

```
Save Data :
1. TinTin [Level : 24]        <
2. Justine [Level : 6]
3. Winata [Level : 1]
4. Back
```

Figure 4. Load Data

3. If user choose **Setting (Menu 3)**, then:

o   **Show** all available **input**.

```
Welcome to the game!

Basic Movement
'w' - Move Up
'a' - Move Left
's' - Move Down
'd' - Move Right

Lobby Arena
'SPACE' - Intersect
'y' - Talk
'o' - Open Backpack

Game Arena
'SPACE' - Shoot
'r' - Reload
'f' - Skill
'1' - Use Potion
'2' - Use Max Potion
'3' - Use Energy
'4' - Use Max Energy
'g' - Use Bomb

Back to menu ? [press enter]
```

Figure 5. Setting

4. If user choose **How to Play (Menu 4)**, then:

   o **Show** main objective of the game.

```
Space Invader


The object of the game is, basically, to shoot the invaders with your shooter
while avoiding their shots and preventing an invasion  Amassing a high score is a further
objective and one that must be prioritised against your continued survival.


There is no time limit,
except for the fact that if you do not shoot them all before they reach
the bottom of the screen the game ends.


Credit : TinTin Winata

Back to menu ? [press enter]
```

Figure 6. How to play

5. If user choose **Exit (Menu 5)**, then:

   o **Display** Logo and motto

Figure 7. End Screen

➢ **Gameplay**

   o **Lobby**

      • Spawn player at the **center of bottom of pillars**.

- Display **lobby map, player position, player information**.

- **Validate** if the **player level** is **less than 10**.

- If the **player level** is **less than 10**, then **close** the **spaceship** door.

- If the **player level** is more **than equal 10**, then **open** the **spaceship** door.

- This is player information below :

Player Attribute	Value
Default XP	0
Default Level	0
Default Money	0
Symbol	P
Default HP	100
Default Energy	50
Default Armor	1
Max HP	300
Max Energy	500
Max Armor	30

Table 1. Player Information

- Print **NPC** with the given symbol.

- If user stands the **middle of lobby map** (fountain), then :

    ❖ Tell **user** can do **interact** by **typing 'SPACE' key.**

    ❖ **Player** can go to the **game arena**

- Below is some information of map symbols.

Symbol	Meaning
|	Board
\ or /	Door
-	Closed Door
# or =	Wall
.	Pillar
P	Player
U	Upgrade Shop
I	Item Shop
W	Spaceship Station

Table 2. Map information

- Prompt user to input **key W A S D** (Case Insensitive) to **move**.

- Validate that player **cannot pass through walls and pillars**.

- If user type key **O** (Case Insensitive), display player's **backpack information**.

```
###################################
#                                 #
#    /#########################\   #
#    #                     #   #   #
#    #                W  #  #   #        [TinTin]
#    #                   #  #   #        Level : 28
#    #                   #  #   #        Money : 3440
#    \#       ##################/  #
#    /     \                       #
#         /\_ _/\                  #
#    |     /  . .  \               #
#    |     .  . .                  #
#    |     \  . .  /               #
#          \_   _/                 #
#                                  #
#    ######      P        #####    #
#    #    #/           \#    #     #
#    # U                  I #      #
#    #    #               #  #     #
#    ######       .   .   #####    #
#              .      .            #
#              .      .            #
##################===##############
```
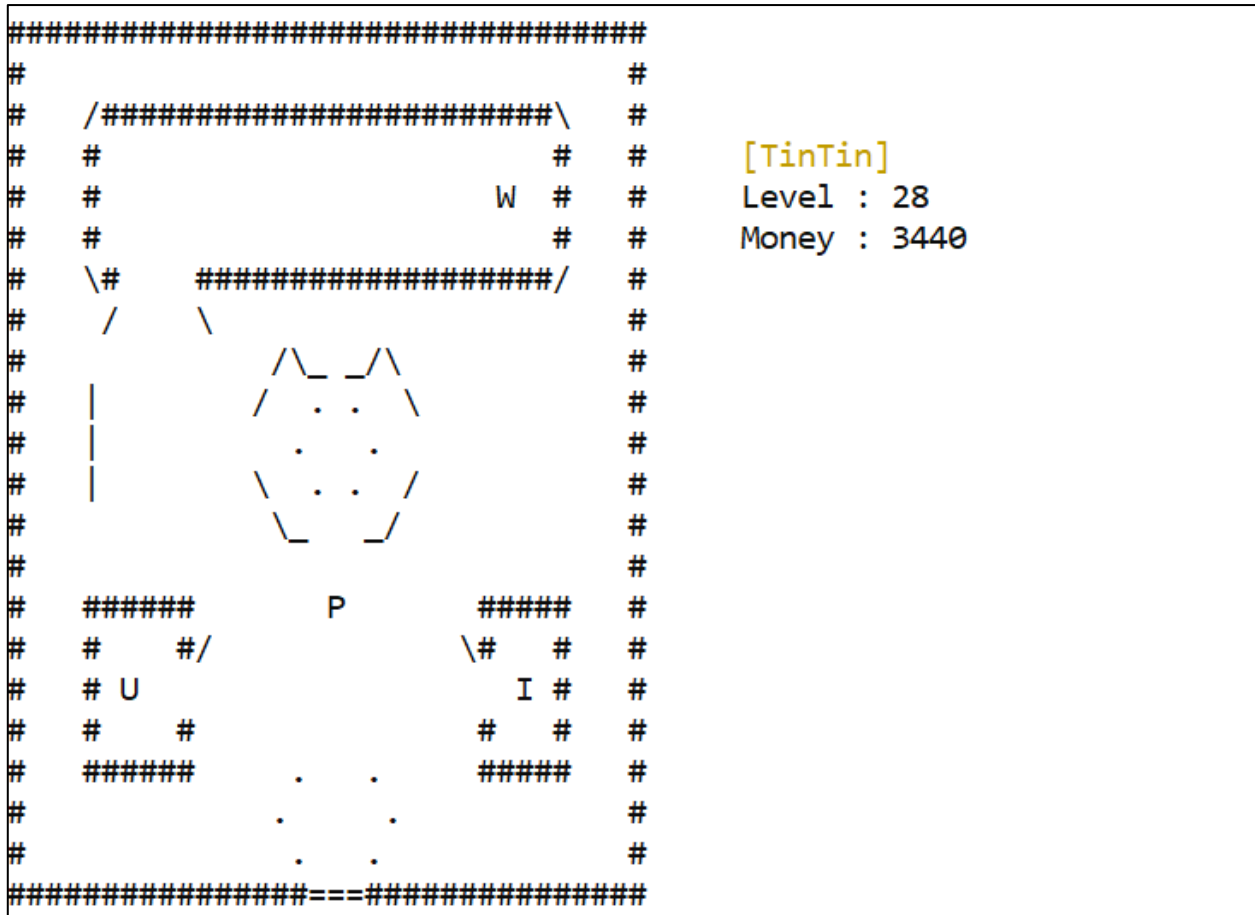
Figure 8. Lobby (Spaceship Door Open)

```
###############################
#                             #
#   /#####################\   #
#   #                 #   #   #
#   #             W  #  #   #        [Winata]
#   #                 #   #   #      Level : 1
#   \#----##############/  #         Money : 3000
#                          #
#         /\_ _/\          #
#   |     /  . .  \        #
#   |     .  . .           #
#   |     \  . . /         #
#          \_   _/         #
#                          #
#   ######        #####    #
#   #    #/     \#    #     #
#   # U            I #      #
#   #    #         #  #     #
#   ######  .   .  #####    #
#         .   P   .        #
#            .   .         #
################===###########
```
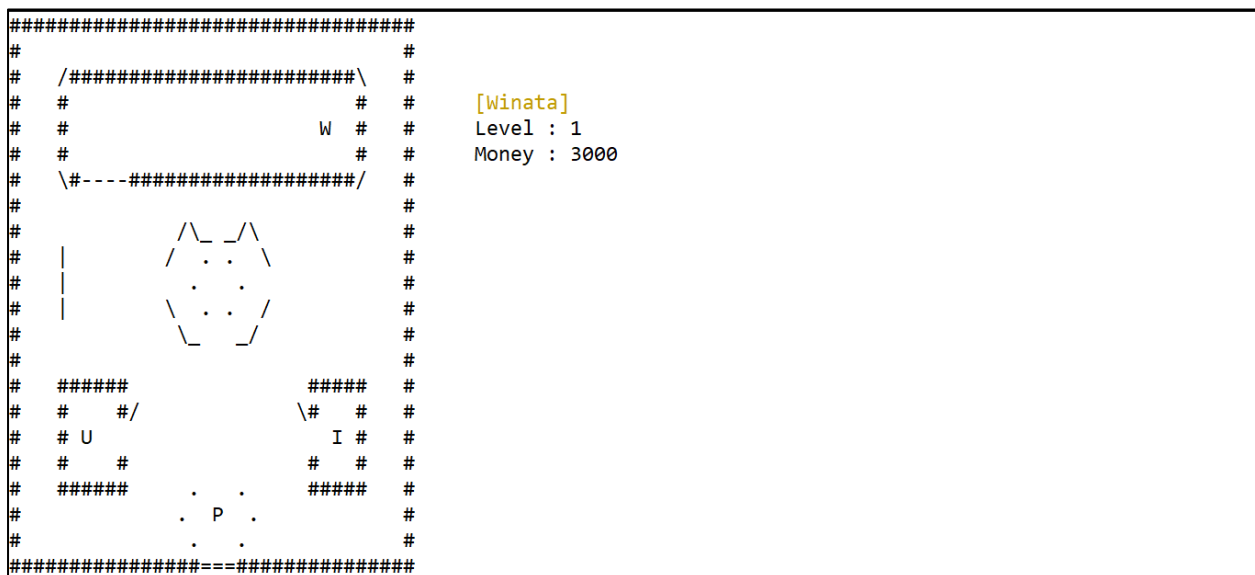
Figure 9. Lobby (Spaceship Door Closed)

```
TinTin backpack's
=====================
- Max Potion : 3
- Bomb : 99


back to game [press enter]
```

Figure 9. Open Backpack

- If users **stand in front** of **closed door**, then display a **message need to level 10**

```
###################################
#                         #
#   /####################\   #
#   #              # #   [Winata]
#   #            W # #   Level : 1
#   #              # #   Money : 3000
#   \#----#################/   #
#     P                  #
#         /\_ _/\          #
#   |    /  . . \         #
#   |       .  .          #
#   |    \  . . /         #
#         \_  _/          #
#                         #
#   ######        #####  #   You need level 10 to unlock spaceship
#   #  #/      \#  #  #
#   # U          I #  #
#   #  #          # #  #
#   ######  .  .  #####  #
#       .  .        #
#       .  .        #
#################===###############
```

Figure 10. Closed Door Message

- If users stand in the front of **Board**, then :

  ❖ Tell **user** can do **interact** by **typing 'SPACE' key.**

  ❖ If users input **'SPACE'** then:

    ▪ Open **'database/score.dat'**

    ▪ Read all the data in **score.dat** with this following format :

playername#score

Format 1. Score.dat

  ▪ Sort the **name and score** on score.dat **based on the score**, and **display** it on the prompt.

  ▪ For **sorting algorithm** you can choose one of algorithm below :

    ♦ Bubble Short

    ♦ Quick Sort

♣ Merge Sort

■ If user press **'ENTER'** back to **lobby**.

```
C Space Invader Scoreboard
==================================

1. TinTin | 110
2. Justine | 70
3. Winata | 20

Back to menu ? [press enter]
```

Figure 11. Scoreboard

- If player position is at **U (upgrade Shop)**, then:

  ❖ Tell user can do interact by typing **'SPACE'** key.

  ❖ If user press **'SPACE'**, then user will interact to **NPC**. **NPC** will ask user to go the shop menu.

  ❖ If user press **'y'**, then:

    ■ **Display** user **upgrade shop menu**.

    ■ **Prompt** user to **input chosen menu. Validate** the input must **between 1 and 4 inclusively**.

    ■ If user choose upgrades attribute **validate user money is enough and validate attribute is not at the maximum level**.

      ♣ If **money is not enough** or **attribute is not at the maximum level**, **display error message**.

      ♣ If **money is enough** and **attribute is not at the maximum** decrease the **money**, increment the **player attribute by 1**, and **display succesfull message**.

    ■ If user choose **4**, then **back to lobby**.

  ❖ Remember please validate if you can't press **'y'** to open shop if you never interact with NPC.

```
#################################
#                               #
#   /#####################\      #
#   #                     #  #      [TinTin]
#   #                  W  #  #      Level : 30
#   #                     #  #      Money : 3660
#   \#     ################/  #
#   /   \                     #
#        /\_ _/\              #
#   |   /  . . \             #
#   |      .  .              #      Hohoo! This is an upgrade shop
#   |   \ . . /              #      Any thing i can do for you ? [y\n]
#        \_  _/              #
#                            #      Press SPACE To Interact
#   ######         #####     #
#   #    #/       \#  #      #
#   # UP            I #      #
#   #   #          #  #      #
#   ######  .  .   #####     #
#          .  .              #
#           .  .             #
#################===##############
```

Figure 12. NPC will ask to go shop menu

```
    Do you need anything to upgrade ?
    1. HP 100/300 - $50                <
    2. Energy 50/500 - $50
    3. Armor 3/30 - $30
    4. Back
```

Figure 13. Upgrade shop menu

```
Do you need anything to upgrade ?
1. HP 103/300 - $50
2. Energy 50/500 - $50
3. Armor 3/30 - $30
4. Back

Succesfully upgraded skills [press enter]
```
Figure 14. Successfully upgrade player attributes

```
Do you need anything to upgrade ?
1. HP 103/300 - $50
2. Energy 50/500 - $50
3. Armor 30/30 - $30
4. Back

You already at the max levels [press enter]
```

Figure 15. Ugrade shop invalid validation

- If player position is at **I (Item Shop)**, then:
  - ❖ Tell user can do interact by typing **'SPACE'** key.

- ❖ If user press **'SPACE'**, then user will interact to **NPC**, **NPC** will ask user to go the shop menu.
- ❖ If user press **'y'**, then:
  - ▪ **Display** user **item shop menu**.
  - ▪ **Prompt** user to **input chosen menu. Validate** the input must **between 1 and 6 inclusively**.
  - ▪ If user choose items , then:
    - ♦ **Prompt** user to **input the quantity** to buy.
    - ♦ **Calculate total price** by **multiplication** of price and quantity. **Validate** user money is **enough to pay** the **total price**.
    - ♦ If user **money is enough**, **reduce user money** by **total price add items to** user's data, and display **succesfull message**. Then **back to lobby**.
    - ♦ If money is **not enough**, display **error message**. Then **back to lobby**.
  - ▪ If user choose **6**, then **back to lobby**.
- ❖ Remember please validate if you can't press **'y'** to open shop if you never interact with NPC.

```
################################
#                              #
#   /#####################\    #
#   #                  #   #        [TinTin]
#   #                W #   #        Level : 24
#   #                  #   #        Money : 3430
#   \#   ################/    #
#    /    \                    #
#         /\_ _/\              #
#   |    /  . .  \             #
#   |    |  . .   |            #
#   |     \ . . /              #
#          \_  _/              #       Welcome to item shop!
#                              #       Do you want to buy any item ? [y\n]
#                              #
#   ######           #####     #       Press SPACE To Interact
#   #   #/          \#  #      #
#   # U               PI #     #
#   #   #              #  #     #
#   ######     .   .   #####    #
#            .   .             #
#            .   .             #
################===#############
```

Figure 16. NPC will ask to go item shop menu

```
Welcome to the item shop
1. Potion [$5]                    <
2. Max Potion [$20]
3. Energy Drink [$3]
4. Max Energy Drink [$15]
5. Bomb [$10]
6. Back
```

Figure 17. Item shop menu

```
Welcome to the item shop
1. Potion [$5]
2. Max Potion [$20]
3. Energy Drink [$3]
4. Max Energy Drink [$15]
5. Bomb [$10]
6. Back

How many Potion do you want to buy ?
- 3


Succesfully Purchased 3 Potion! [press enter]
```

Figure 18. Successfully purchase item.

```
Welcome to the item shop
1. Potion [$5]
2. Max Potion [$20]
3. Energy Drink [$3]
4. Max Energy Drink [$15]
5. Bomb [$10]
6. Back

How many Potion do you want to buy ?
- 100000000


You dont have enough money! [press enter]
```

Figure 19. Invalid validation item shop.

- If player position is at **W (Spaceship Station)**, then:
  - ❖ Tell user can do interact by typing **'SPACE'** key.
  - ❖ If user press **'SPACE'**, then user will interact to **NPC**, **NPC** will ask user to go the shop menu.
  - ❖ If user press **'y'**, then:

- **Display** current **spaceship**.

- User can change current spaceship by input **'A' to (Left)** and **'D' to (Right)**.

- Remember, there's **no min or max spaceship** validation, if user input **'D'** when **the current spaceship is last** then **back to first spaceship**.

- User can **choose the spaceship** by input 'ENTER'. And return to **lobby**.

❖ Remember please validate if you can't press **'y'** to open shop if you never interact with **NPC**.

```
Welcome to the station!
 Select your spaceship!

   Great Spaceship

         ^
       /   \
      |  x  |
       \___/
         v

[press enter to choose]
< ------------------- >
```

Figure 20. Choose Spaceship

- If player position is at **bottom of the map** then:

  ❖ Tell user can do interact by typing **'SPACE'** key.

  ❖ If user input **'SPACE'** then :

    - **Open 'database/player.dat'**

    - Below is the player format on **player.dat**.

name#money#xp#level#hp#energy#armor#damage

Format 1. Player.dat format Player

- Validate if user exists in **player.dat**

- If user **is exists** :

  ♦ **Update the user on player.dat**

- If user **is not exists** :

  ♦ **Make a new user line in player.dat**

- Display **main menu**.

- Below is some information about **Upgrade Shop**.

Attribute Name	Price
HP	$50
Energy	$50
Armor	$30

Table 3. Upgrade Shop Information

- Below is some information about **Item Shop**.

Item	Price
Potion	$5
Max Potion	$20
Energy Drink	$3
Max Energy Drink	$15
Bomb	$10

Table 4. Item Shop Information

- There are any **cheat codes** that's run in the lobby**, to activate the cheat code**, user needs to **run buffers** below :

Buffers	Cheat Code
W + A + S + D + W + A+ S + D + W + A + S + D + W + A + S + D	Bomb = 99
A + S + D + A + S + D + A + S + D + A + S + D	All Item (Except bomb) = 99
W + S + W + S + W + S + A + D + A + D + A + D	Player max attribute
D + A + S + W + D + A + S + W + D + A + S + W + D + A + S + W	Player max level

Table 5. Cheat Code

- ○ **Shooter Arena**

  - **Display shooter information** (spaceship name, score, bullets, hp, energy).

  - Every 3 seconds **Random 3 Enemies** with this following criteria :

    ❖ Randomize **1 – 3** for the enemy level.

    ❖ Every **4 seconds** enemy will **move** left - right **and** right - left **continously**.

    ❖ Every **3 – 4 seconds** (Randomize) enemy will **shoot** a bullet.

  - Below is some information about **Enemy.**

Level	Sprite	Damage	HP
1	\v/	10	1
2	\x/	20	1
3	\o/	25	1

Table 6. Enemy Information

- Display player shooter with this criteria :

❖ **Display sprite** based on their **referencee on Spaceship Station**. The default spaceship is 'Default Spaceship'.

❖ Below is some information about **shooter movement.**

Key (Case Insensitive)	Shooter Event
R	Reload
W	Move Up
S	Move Down
D	Move Right
A	Move Left
SPACE	Shoot
F	Skill
1	Potion
2	Max Potion
3	Energy
4	Max Energy
G	bomb

Table 7. Shooter Information

```
 \x/ \x/ \x/                      |
      \v/ \v/ \v/                 |
              \o/ \x/ \v/         |
                                  |
                                  |
                                  |
                  *               |   C Space Invader
                                  |   Default Spaceship
                                  |
                                  |   Score : 00
                                  |   Bullets 10/10
                                  |
                     *            |   HP [100/100]
            *                     |   Energy 50/50
                                  |
                                  |
         / \                      |
        /  .  \                   |
        |.x.|                     |
        \___/                     |
           v                      |
                                  |
_____ |
                                  |
```

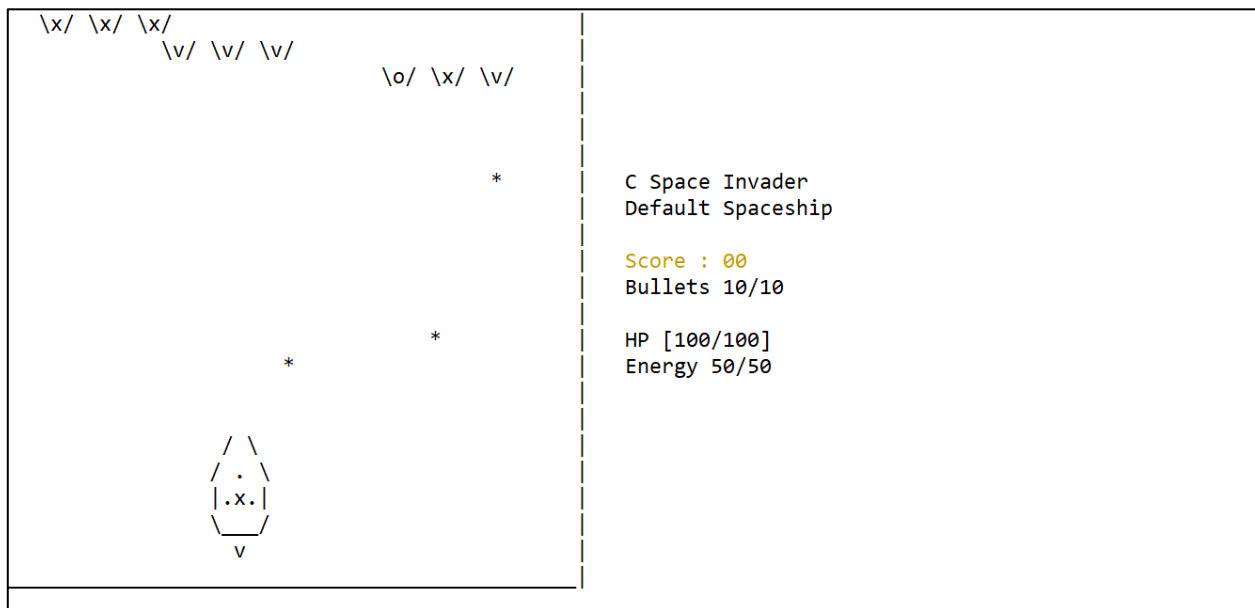**Figure 21. Shooter Arena**

❖ Every **20 milliseconds** increment **energy by 0.1**.

❖ When user reloading, **reset the bullet to total bullet**.

❖ When user **shoot**, then :

▪ **Validate** if shoot **have any bullet left.**

▪ If **there are any shoot left**, make **a new bullet with given symbol**.

- **The direction of the bullet is always go up**.

```
|                        |                |
|                        |                |
|                        |                |
|           ^            |  C Space Invader
|           ^            |  Default Spaceship
|           ^            |
|           ^            |  Score : 00
|           ^            |  Bullets 00/10
|           ^            |
|           ^            |  HP [100/100]
|                        |  Energy 50/50
|                        |
|                        |
|         / \            |
|        / . \           |
|        |.x.|           |
|        \___/           |
|          v             |
|_____|
```
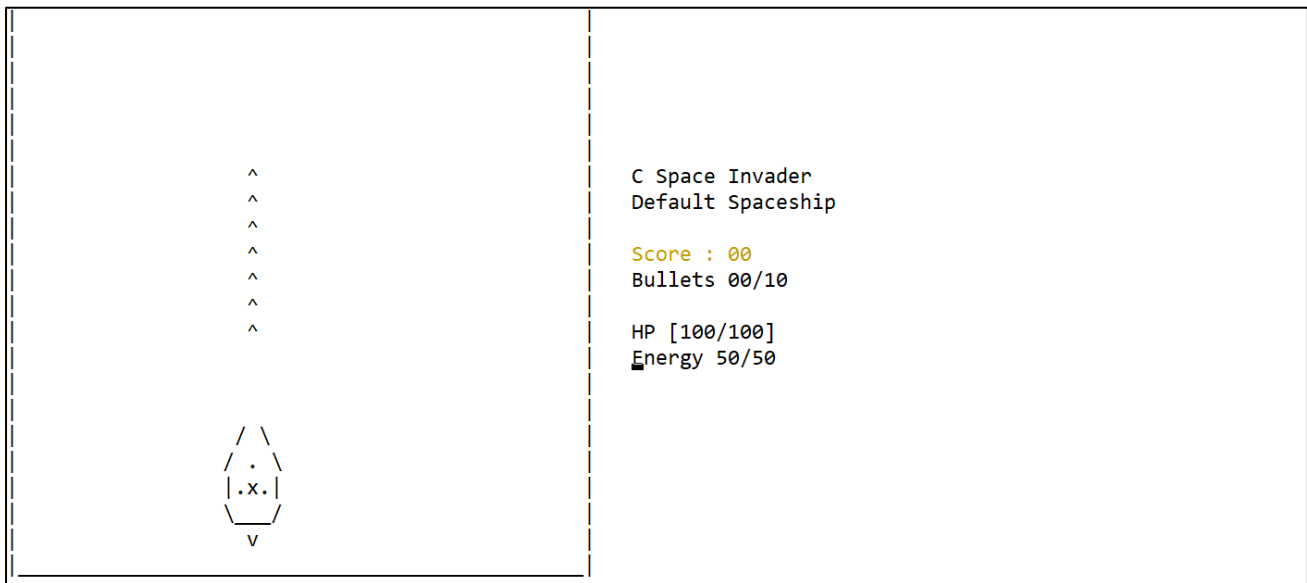
Figure 22. Shooter Shoot

❖ When user skills, then :

- **Validate** if **shooter energy is more than skill cost** and have minimum **3 bullets.**

- If shooter energy is **more than skill cost** and **have 3 bullets** then **decrement energy** by skill cost, **decrement bullets** by **3 ,** spawn a three bullet with 3 direction **(Up, Up-Left, Up-Right)**.

```
|    \x/ \o/ \o/         |
|                        |
|                        |
|                        |  C Space Invader
|                        |  Default Spaceship
|                        |
|                        |  Score : 00
|    ^     ^     ^       |  Bullets 03/10
|                        |
|                        |  HP [100/100]
|                        |  Energy 20/50
|                        |
|         / \            |
|        / . \           |
|        |.x.|           |
|        \___/           |
|          v             |
|_____|
```

Figure 23. Shooter Skill

❖ **Remember**, bullets damage based on damage on the shooter.

❖ When users use **bombs**, then :

▪ **Fill map** with **bomb symbol.**

▪ If there are any **enemy when filling the map**, then **enemy will die.**

▪ Please use **floodfill algorithm** to fill the map.

```
                          \o/ \o/ \x/
        \v/ \x/ \v/
                        \v/ \o/ \o/
    \v/ \x/ \v/
                      \x/ \v/ \o/
    \o/ \o/ \v/            *
       *      \v/      \x/      *        C Space Invader
         *                               Default Spaceship

                                         Score : 10
                   *                     Bullets 09/10

           *                             HP [76/100]
                 *                       Energy 50/50

          *                      / \
                                / . \|
                                |.x.||
                     *          \___/|
                                  v
```
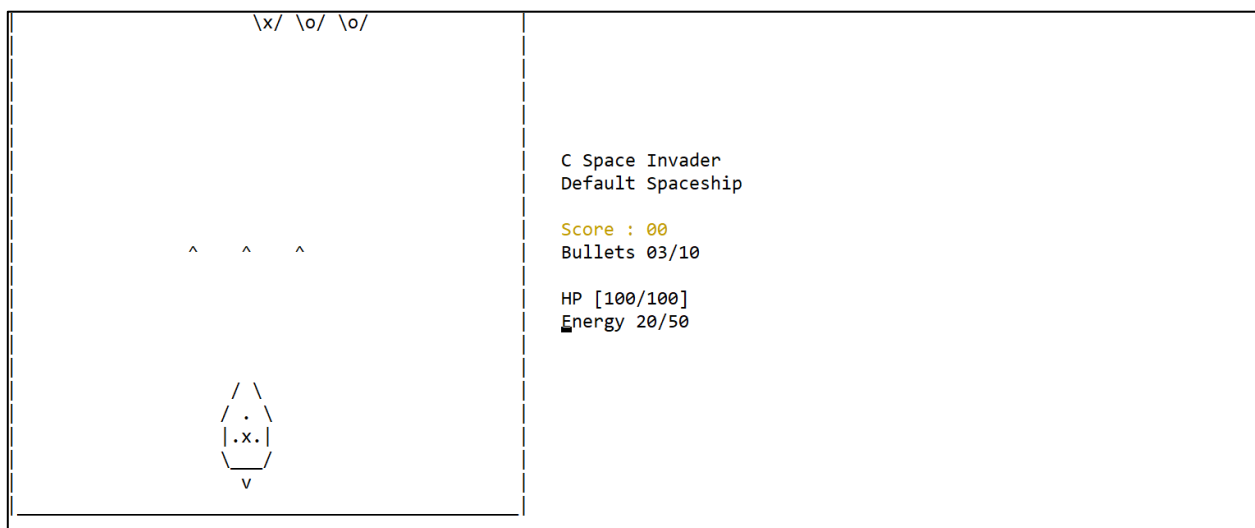
Figure 24. Before Bomb

```
. . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . .    C Space Invader
. . . . . . . . . . . . . . . . . . . . .    Default Spaceship
. . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . .    Score : 60
. . . . . . . . . . . . . . . . . . . . .    Bullets 10/10
. . . . . . . . . . . . . . . . . . . . ▪|
. . . . . . . . . . . . . . . . .            HP [100/100]
. . . . . . . . . . . . . . . . .            Energy 50/50
. . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . .            BOMB!
. . . . . . . . . . . . . . / \
. . . . . . . . . . . . . . / . \|
. . . . . . . . . . . . . .   . .
. . . . . . . . . . . . . . \ _ /|
. . . . . . . . . . . . . . . . .
```

Figure 25. Bomb

```
|                              |                                   |
|.                             |                                   |
|                              |                                   |
|                              |                                   |
|                              |   C Space Invader                 |
|                              |   Default Spaceship               |
|                              |                                   |
|                              |   Score : 30                      |
|                              |   Bullets 10/10                   |
|                              |                                   |
|                              |   HP [100/100]                    |
|                              |   Energy 50/50                    |
|                              |                                   |
|                              |   BOMB!                           |
|                       / \    |                                   |
|                      / . \   |                                   |
|                      |.x.|   |                                   |
|                      \___/   |                                   |
|                        v     |                                   |
|_____|                                   |
```
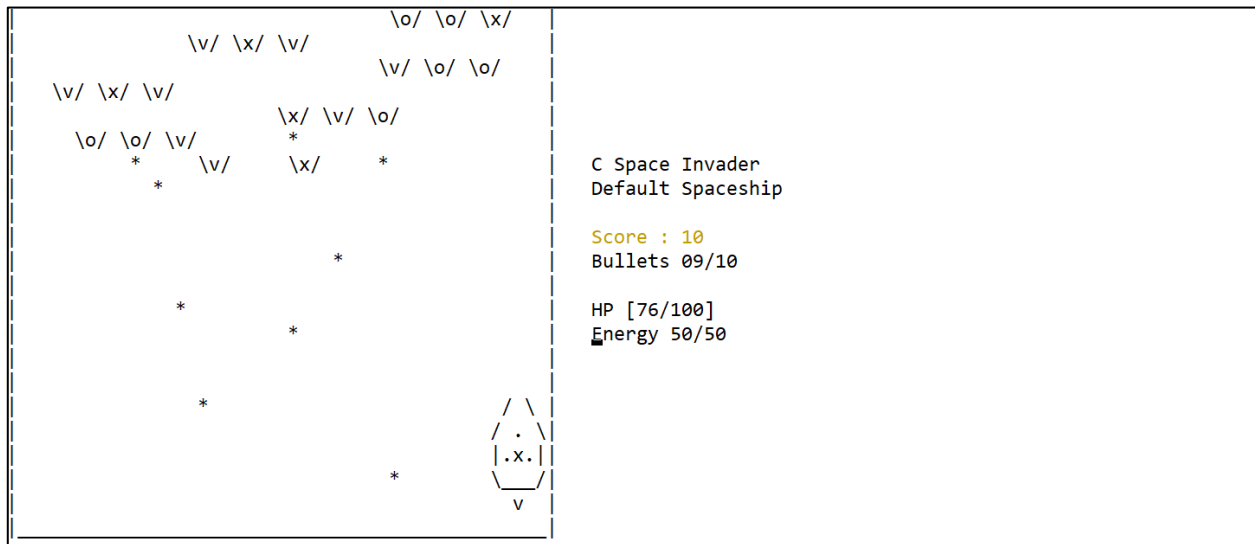
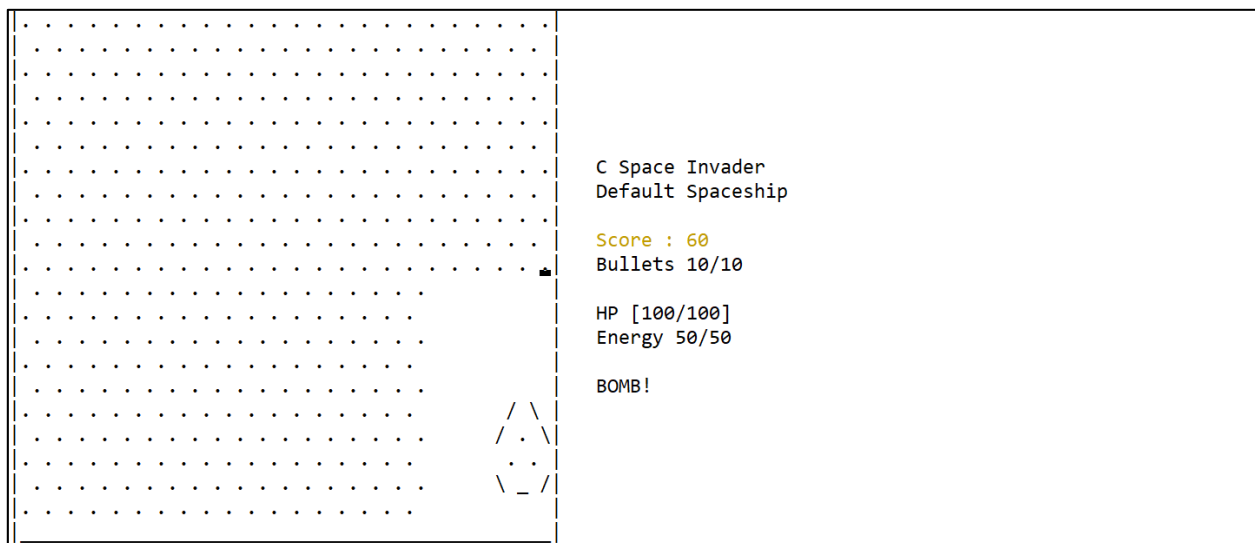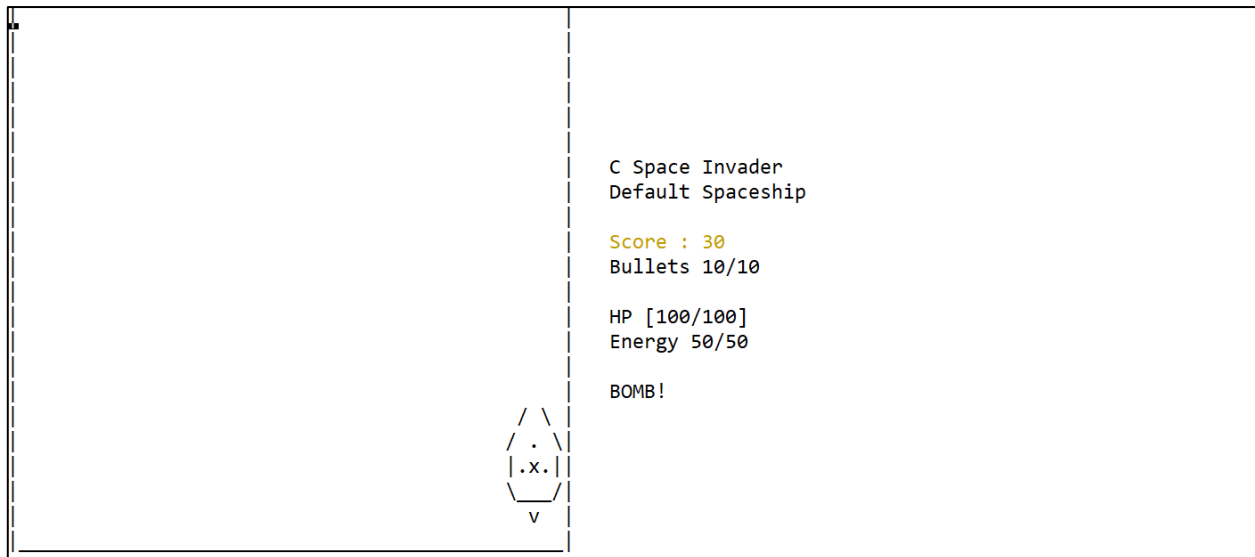**Figure 26. After Bomb**

- ❖ When **users use potion,** then **increment shooter hp by 50**, and decrement the potion by 1.

- ❖ When **users use max potion**, then **set shooter hp to max**, and decrement by max potion 1.

- ❖ When **users use energy drink**, then **increment energy by 50**, and decrement the energy drink by 1.

- ❖ When **users use max energy drink**, then **increment energy to max**, and decrement the max energy drink 1.

- ❖ Don't forget to **validate**, if there's **no item left**. User **can't use the item** and **display error message**.
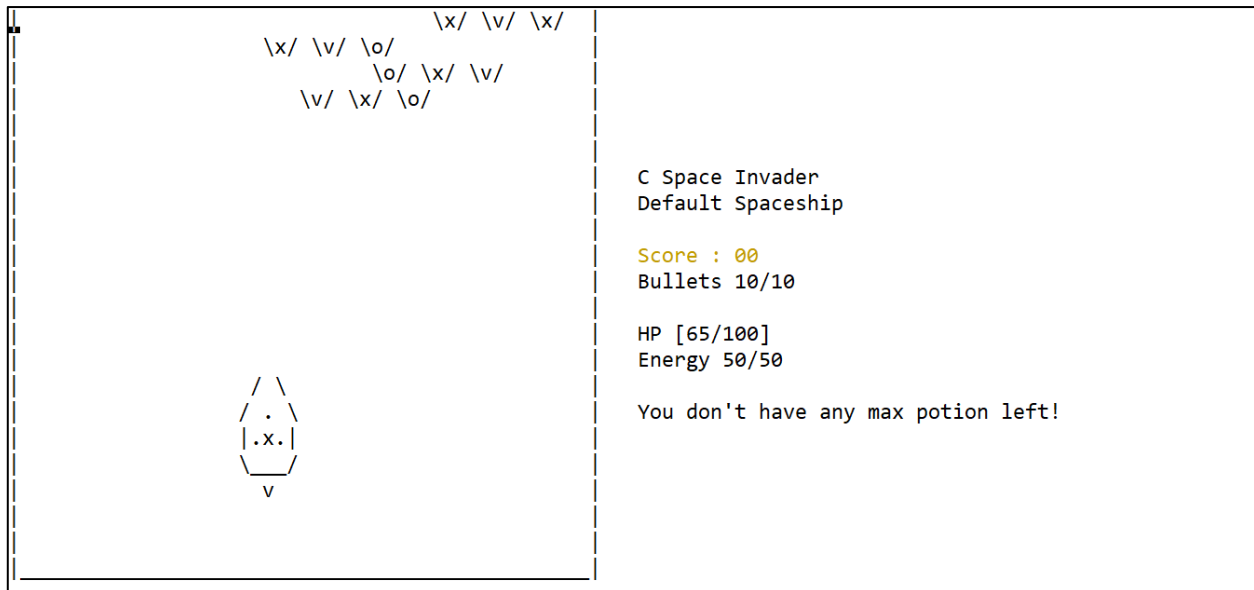
```
                          \x/ \v/ \x/  |
            \x/ \v/ \o/                |
                   \o/ \x/ \v/         |
            \v/ \x/ \o/                |
                                       |
                                       |    C Space Invader
                                       |    Default Spaceship
                                       |
                                       |    Score : 00
                                       |    Bullets 10/10
                                       |
                                       |    HP [65/100]
                                       |    Energy 50/50
                                       |
              / \                      |    You don't have any max potion left!
             / . \                     |
             |.x.|                     |
             \___/                     |
               v                       |
                                       |
                                       |
     _____|
```

Figure 27. No item left error message.

❖ When use Item don't forget to **display successfully used item**.

```
          \o/ \v/ \v/                  |
                                       |
                                       |
                                       |
                                       |    C Space Invader
                                       |    Default Spaceship
                                       |
                                       |    Score : 00
                                       |    Bullets 10/10
                                       |
                                       |    HP [100/100]
                                       |    Energy 50/50
                                       |
              / \                      |    Used Energy Drink!
             / . \                     |
             |.x.|                     |
             \___/                     |
               v                       |
     _____|
```
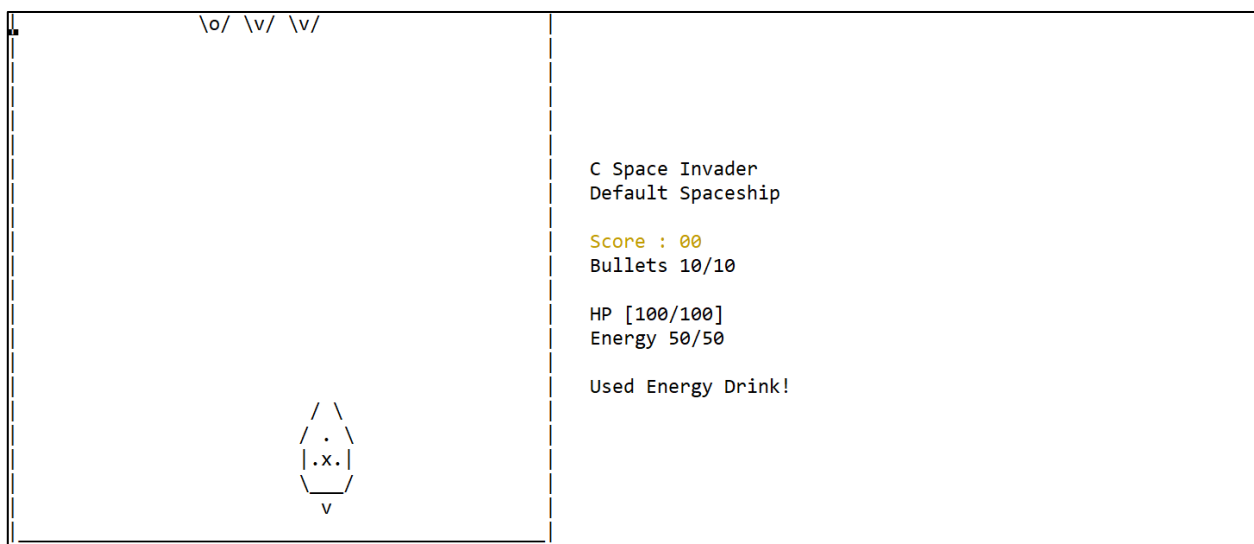
Figure 28. Succesfuly use item message.

❖ **Please remember** any changes on shooter while game is running, please **update the shooter status**.

❖ Below is some **information** about shooter attributes :

Shooter Attribute	Value
Reload Time	1 Seconds
Skill Cost	30
Damage	1
Total Bullet	10

Bullet Symbol	^
Skill Symbol	o
Bomb Symbol	.

Table 29. Shooter Information

- **Render** all **player bullets** that available with this criteria:
  - ❖ **Validate** if player bullet **outside the map** then, **dissapper/remove** the bullet.
  - ❖ If player bullets **intersect with enemy**, then :
    - ▪ **Dissapper / remove** current bullet.
    - ▪ **Decrement enemy hp** by shooter damage.
    - ▪ If intersected enemy hp is **below than** 0, then enemy **will die and increment score by 10.**
- **Render** all **enemy bullets** that available with this criteria:
  - ❖ **Validate** if enemy bullet **outside the map** then, **dissapper/remove** the bullet.
  - ❖ If enemy bullets **intersect with the shooter**, then :
    - ▪ **Dissapper/remove** current bullet.
    - ▪ **Decrement shooter hp** by enemy damage, if shooter hp is below than 0, then **stop the game and display Finish Game**.
  - o **Finish Game**
    - Display **total score** that earned.

$$\text{Gained XP} = \text{Total Score} * 0.75$$

Equation 1. Gained XP

- Open '**database/score.dat'** then :
  - ❖ If the name **isn't exists** :
    - ▪ **Create new line** with **current player name and score**.
  - ❖ If the name **already exists** :
    - ▪ If the score in **'score.dat'** is **less than current score**, then **update the score.**
- Display **gained XP** that earned.
- **Maximum XP on shooter is 100**, when XP is more than Maximum XP then :
  - ❖ Decrement **XP** by maximum XP

❖ Increment 1 level to **player**.

- Display **current level**.

- If user input **'ENTER'** then back to **lobby**.

```
C Space Invader
------------------
Your score : 60
You gain 45 exp
Your current level is : 28

Continue Game [press enter]
```

Figure 30. Finish Game Menu

➢ **Miscellaneous & Rules**

- Please **don't make any changes** on folder **assets** or **moving out files from folder assets**.

- You can modify and change files on **database** folder.

- Save format for score.dat is **username#score**.

- Save format for player.dat is **name#money#xp#level#hp#energy#armor#damage**

Please run the EXE file to see the sample program.