# Workshop 5

***Worth: 4% of final grade***

*Breakdown: Part-1 Coding: 10% | Part-2 Coding: 40% | Part-2 Reflection: 50%*

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## Introduction

In this workshop, you will code and execute a C language program applying user-defined data types (structures). You will be programming a small game that has hidden bombs and treasure along a path of variable distance. The game requires the player to enter move location commands to reveal what is hidden at a given position along the path. The object of the game is for the player to find as many treasures as possible before running out of moves or lives. Discovering a bomb will reduce the player's life count. Discovering a treasure will earn the player treasure points. Discovering both, a treasure with a bomb in the same location will reduce the player's life count and earn the player treasure points (consider it a life insurance payout). Prior to playing the game, the program will prompt the user to perform some upfront configurations to the player and the game components – these settings will define how the game is played.

## Topic(s)

- Modularity: **Structures**

## Learning Outcomes

Upon successful completion of this workshop, you will have demonstrated the abilities:

- to store data of different data types using a structure type
- to declare an object of structure type
- to access the members of an object of structure type
- To describe to your instructor what you have learned in completing this workshop

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## Submission Policy

- Part-1 is due on Thursday
- Part-2 is due on Sunday
- In each case, the due date is the **end of day by 23:59** EST (UTC – 5)
- **Late submissions will NOT be accepted**

**All files** you create or modify MUST contain the following 4 pieces of information; your:

1. Full name
2. Student Number
3. Seneca Email Address
4. Section Information Code

Notes

- Due dates are in effect **even during a holiday**
- You are responsible for **backing up your work regularly**

## Late Submission/Incomplete Penalties

If any Part-1, Part-2, or Reflection portions are missing, the mark will be **ZERO**.

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## Part-1 (10%)

### Instructions

Download or clone workshop 5 (**WS05**) from https://github.com/Seneca-144100/IPC-Workshops
**Note**: If you use the download option, make sure you **EXTRACT** the files from the .zip archive file

Part-1 will focus on the **player** and **game** configuration settings in preparation for gameplay which will be done in Part-2.

1. Carefully review the "Part-1 Output Example" (next section) to see how this program is expected to work (Note: This game is highly user-configurable and should be coded to implement the settings as defined by the user and not be limited to just the example provided – you will have to test your work thoroughly in both part's 1 and 2!)
2. Code your program in a file named "**w5p1.c**"
3. You will need to create a user-defined data type called **PlayerInfo** which is used for configuring a player in the game with members that can store the following related information:
   - The **number of "lives"** a player can have for the game
   - A **character symbol** that will be used to represent the player
   - A counter to store the **number of "treasure's"** found during the game
   - A **history of all past entered positions** entered by the player during the game (hint: you should size this array based on a macro that represents the **maximum path length** that a game can be configured for – see example output to see what the maximum is)
4. You will need to create another user-defined data type called **GameInfo** which is used for configuring the game settings with members that can store the following related information:
   - The **maximum number of "moves"** a player can make for a game
   - The **path length** (number of positions) the game path will have for a game
   - A series of **0**'s and **1**'s in an array that represents where **bombs** are buried along the path (hint: you should size this array based on a **macro that represents the maximum path length** that a game can be configured for – see example output to see what the maximum is)
   - A series of 0's and 1's in an array that represents where **treasure** is buried along the path (hint: you should size this array based on a **macro that represents the maximum path length** that a game can be configured for – see example output to see what the maximum is)

5. Configure the **player** (store these values to a variable of type **PlayerInfo**):
   - Prompt to set the player's **character symbol** (any printable character that will represent the player)
     - Note: Place a **single space** before the % specifier in the scanf to properly read this value
       ```
       scanf(" %c"...
       ```
   - Prompt to set the **number of lives** a player is limited to for the game
     - The value must be between **1** and **10** inclusive
     - Note: you should design your code so that the maximum value rule can be easily modified in one place, so you **do not need to make changes to the logic** of the program
     - Validation should repeat as many times as necessary until a valid value is entered
   - Make sure the history of moves (all user entered positions during gameplay) is set to a safe empty state – **you should assume there is potentially previous game data still stored that needs each element to be reset)**
6. Configure the **game** (store these values to a variable of type **GameInfo**):
   - Prompt to set the **length of the game path** (this is the number of positions in the path)
     - The value must be between **10** and **70**
     - The value must be a **multiple of 5**
     - Note: you should design your code so that these rules (values: 5, 10, 70) can be easily modified in one place, so you **do not need to make changes to the logic** of the program
     - Validation should repeat as many times as necessary until a valid value is entered
   - Prompt to set the **maximum number of moves** a player can make during gameplay
     - The value must be at least the value of the **player's "lives"** setting
     - The value cannot be greater than 75% of the game's **path length** setting (round down to nearest whole number)
     - Validation should repeat as many times as necessary until a valid value is entered
   - Prompt to set the **BOMB's** placements along the path (within the game's path length limits)
     - Values **must be entered 5 at a time** (sets of 5) until all positions along the set path length are set (space delimited)
       - Reminder: The multiple of 5 rule can be modified with another version of this application and should be coded with this mind (see note at the beginning of #6)
     - A '**1**' value represents a **hidden bomb**, while a '**0**' value represents **no bomb**
     - Note: You do not need to validate for **1**'s and **0**'s; you may assume this is entered properly
   - Prompt to set the **TREASURE** placements along the path (within the game's path length limits)
     - The same rules apply as described for the bomb settings
7. As the last major step, **display a summary** of the values entered that will define the gameplay

Part-1 Output Example *(Note: Use this data for submission)*

```
================================
         Treasure Hunt!
================================

PLAYER Configuration
--------------------
Enter a single character to represent the player: @
Set the number of lives: 0
     Must be between 1 and 10!
Set the number of lives: 11
     Must be between 1 and 10!
Set the number of lives: 3
Player configuration set-up is complete

GAME Configuration
------------------
Set the path length (a multiple of 5 between 10-70): 9
     Must be a multiple of 5 and between 10-70!!!
Set the path length (a multiple of 5 between 10-70): 71
     Must be a multiple of 5 and between 10-70!!!
Set the path length (a multiple of 5 between 10-70): 19
     Must be a multiple of 5 and between 10-70!!!
Set the path length (a multiple of 5 between 10-70): 35
Set the limit for number of moves allowed: 2
    Value must be between 3 and 26
Set the limit for number of moves allowed: 27
    Value must be between 3 and 26
Set the limit for number of moves allowed: 10

BOMB Placement
--------------
Enter the bomb positions in sets of 5 where a value
of 1=BOMB,and 0=NO BOMB. Space-delimit your input.
(Example: 1 0 0 1 1) NOTE: there are 35 to set!
   Positions [ 1- 5]: 0 0 0 0 1
   Positions [ 6-10]: 1 0 0 1 1
   Positions [11-15]: 1 0 1 1 1
   Positions [16-20]: 0 1 0 0 0
   Positions [21-25]: 1 0 1 0 0
   Positions [26-30]: 0 0 0 1 0
   Positions [31-35]: 1 0 1 0 1
BOMB placement set

TREASURE Placement
------------------
Enter the treasure placements in sets of 5 where a value
of 1=TREASURE, and 0=NO TREASURE. Space-delimit your input.
```

```
(Example: 1 0 0 1 1) NOTE: there are 35 to set!
   Positions [ 1- 5]: 0 0 1 0 0
   Positions [ 6-10]: 1 1 1 0 1
   Positions [11-15]: 1 1 0 1 0
   Positions [16-20]: 0 1 0 0 0
   Positions [21-25]: 1 1 0 1 0
   Positions [26-30]: 1 0 1 0 0
   Positions [31-35]: 0 1 1 1 1
TREASURE placement set

GAME configuration set-up is complete...

-----------------------------------
TREASURE HUNT Configuration Settings
-----------------------------------
Player:
   Symbol     : @
   Lives      : 3
   Treasure   : [ready for gameplay]
   History    : [ready for gameplay]

Game:
   Path Length: 35
   Bombs      : 00001100111011101000101000001010101
   Treasure   : 00100111011101001000110101010001111

===================================
~ Get ready to play TREASURE HUNT! ~
===================================
```

## Part-1 Submission

1. Upload (file transfer) your source file "**w5p1.c**" to your matrix account
2. Login to matrix in an SSH terminal and change directory to where you placed your workshop source code.
3. Manually compile and run your program to make sure everything works properly:

   ```
   gcc -Wall w5p1.c -o w5 <ENTER>
   ```

   *If there are no error/warnings are generated, execute it:* ***w5*** *<ENTER>*
4. Run the submission command below (replace **profname.proflastname** with **your professors** Seneca userid and replace **NAA** with your section):

   ```
   ~profName.proflastname/submit 144w5/NAA_p1 <ENTER>
   ```
5. Follow the on-screen submission instructions

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# Part-2 (40%)

## Instructions

Part-2 involves implementing the gameplay logic based on the configuration settings done from Part-1.

1. Review the "Part-2 Output Example" (next section) to see how the application is expected to work
   Reminder:
   This game is highly user-configurable and should be coded to implement the settings as defined by the user and not be limited to just the example provided – you will have to test your work thoroughly in both part's 1 and 2!
2. Code your program in a file named "**w5p2.c**"
3. Display the "board" which includes:
   - Line-1: The player's most recent move position identified using the **player's** set **symbol**
   - Line-2: The game path:
     - ▒ : represents **undiscovered** locations (use below to print this symbol)
       ```
       printf("%c", 177);
       ```
     - **!** : represents **bombs**
     - **$** : represents **treasure**
     - **&**: represents both a **bomb** and **treasure**
     - **.** : represents a visited location that had neither a **bomb** nor a **treasure**
     - Hint: Use the **player's** history member array to determine if you should reveal the hidden bomb and/or treasure, if a player has visited the position/location, then check what symbol to show by checking the **game's** bombs and treasure member array's
   - Line-3: Position/location ruler (**major**) which will show the 1st number in every 10 positions
     - (**1**0, **2**0, **3**0, etc.)
   - Line-4: Position/location ruler (**minor**) which shows each numeric position starting at 1

   Note:
   The 'ruler' helps the user quickly locate positions and identify previously entered move commands.
   Hint: This is dynamically displayed based on the **game's** setting for the **path length** member
4. Display the **player's** statistics.
   - Lives: is a counter of how many lives are remaining (when this is zero, gameplay ends)
   - Treasures: is a counter of how many treasures were found during gameplay
   - Moves Remaining: is a countdown of remaining moves (when this is zero, gameplay ends)
   - Use the following (add the variables for substitution accordingly where needed):

```
printf("+-------------------------------------------------+\n");
printf("  Lives: %2d  | Treasures: %2d  |  Moves Remaining: %2d\n"...
printf("+-------------------------------------------------+\n");
```

5. Prompt for the **player's** next **move** (location along the path)
    - The entered value must be at least 1 and no more than the **game's** configuration setting for the **path length**
    - Validation should repeat as many times as necessary until a valid value is entered
6. Check to see if the entered location was **previously visited**
    - You should refer to the **player's history** array to see if the location was previously visited (the value will be **1**)
    - If the location was previously visited, display a meaningful message to indicate the location has already been visited
    - Do NOT deduct a move from the **game's move counter**
7. If the entered location was not previously visited:
    - Record the location to the **player's history** array by setting the appropriate element value to 1 (the index is determined by the entered location)
    - Reduce the **moves counter** by **1**
    - Check the **game's bomb** member array (the index is determined by the entered location) to see if there is a hidden bomb (value will be **1**)
        - Reduce the **player's lives** counter by 1
        - Display an appropriate message (use symbol: **[!]** to denote a bomb)
    - Check the **game's treasure** member array (the index is determined by the entered location) to see if there is a hidden treasure (value will be **1**)
        - Increase the **player's treasure** counter by 1
        - Display an appropriate message (use symbol: **[$]** to denote a treasure)
    - Check for BOTH a **bomb** AND a **treasure**
        - Check both the **bomb** and **treasure** member arrays to see if a value of **1** is set for both at the same location
        - Update the player's counters accordingly (bomb: **reduce lives**, treasure: **increase treasure** counter)
        - Display an appropriate message (use symbol: **[&]** to denote a bomb AND treasure, the treasure is considered a "life insurance payout")
    - If there is no bomb or treasure at the location entered by the user
        - Display an appropriate message (use symbol: **[.]** to denote nothing found)

    *Note:* The symbols used in the messages will match to what is shown in the game's board when displayed (step #3 "line-2")
8. Keep iterating (looping) (from #3) until the gameplay ends based on the following criteria:
    - The number of player **lives** reaches **0**
    - The number of allowed **moves** reaches **0**
9. Display a "Game Over" message along with an exit/end of program message.

Part-2 Output Example *(Note: Use this data for submission)*

```
================================
         Treasure Hunt!
================================

PLAYER Configuration
--------------------
Enter a single character to represent the player: V
Set the number of lives: 0
     Must be between 1 and 10!
Set the number of lives: 11
     Must be between 1 and 10!
Set the number of lives: 3
Player configuration set-up is complete

GAME Configuration
------------------
Set the path length (a multiple of 5 between 10-70): 9
     Must be a multiple of 5 and between 10-40!!!
Set the path length (a multiple of 5 between 10-70): 41
     Must be a multiple of 5 and between 10-40!!!
Set the path length (a multiple of 5 between 10-70): 19
     Must be a multiple of 5 and between 10-40!!!
Set the path length (a multiple of 5 between 10-70): 20
Set the limit for number of moves allowed: 2
    Value must be between 3 and 15
Set the limit for number of moves allowed: 16
    Value must be between 3 and 15
Set the limit for number of moves allowed: 10

BOMB Placement
--------------
Enter the bomb positions in sets of 5 where a value
of 1=BOMB, and 0=NO BOMB. Space-delimit your input.
(Example: 1 0 0 1 1) NOTE: there are 20 to set!
   Positions [ 1- 5]: 1 0 0 1 1
   Positions [ 6-10]: 1 1 0 0 0
   Positions [11-15]: 0 0 1 1 1
   Positions [16-20]: 1 0 0 0 0
BOMB placement set

TREASURE Placement
------------------
Enter the treasure placements in sets of 5 where a value
of 1=TREASURE, and 0=NO TREASURE. Space-delimit your input.
(Example: 1 0 0 1 1) NOTE: there are 20 to set!
   Positions [ 1- 5]: 0 1 1 0 0
   Positions [ 6-10]: 0 0 0 0 0
```

```
   Positions [11-15]: 1 1 0 0 1
   Positions [16-20]: 0 1 1 1 1
TREASURE placement set

GAME configuration set-up is complete...

-----------------------------------
TREASURE HUNT Configuration Settings
-----------------------------------
Player:
   Symbol     : V
   Lives      : 3
   Treasure   : [ready for gameplay]
   History    : [ready for gameplay]

Game:
   Path Length: 20
   Bombs      : 10011110000011110000
   Treasure   : 01100000001100101111

===================================
~ Get ready to play TREASURE HUNT! ~
===================================

  ▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒
  |||||||||1|||||||||2
  12345678901234567890
+--------------------------------------------------+
  Lives:  3  | Treasures:  0  |  Moves Remaining: 10
+--------------------------------------------------+
Next Move [1-20]: 0
  Out of Range!!!
Next Move [1-20]: 21
  Out of Range!!!
Next Move [1-20]: 8

===============> [.] ...Nothing found here... [.]

         V
  ▒▒▒▒▒▒▒.▒▒▒▒▒▒▒▒▒▒▒▒
  |||||||||1|||||||||2
  12345678901234567890
+--------------------------------------------------+
  Lives:  3  | Treasures:  0  |  Moves Remaining:  9
+--------------------------------------------------+
Next Move [1-20]: 10

===============> [.] ...Nothing found here... [.]
```

```
          V
  ▒▒▒▒▒▒▒.▒.▒▒▒▒▒▒▒▒
  |||||||||1|||||||||2
  12345678901234567890
+--------------------------------------------------+
  Lives:  3  | Treasures:  0  |  Moves Remaining:  8
+--------------------------------------------------+
Next Move [1-20]: 1

===============> [!] !!! BOOOOOM !!! [!]

  V
  !▒▒▒▒▒▒▒.▒.▒▒▒▒▒▒▒▒
  |||||||||1|||||||||2
  12345678901234567890
+--------------------------------------------------+
  Lives:  2  | Treasures:  0  |  Moves Remaining:  7
+--------------------------------------------------+
Next Move [1-20]: 15

===============> [&] !!! BOOOOOM !!! [&]
===============> [&] $$$ Life Insurance Payout!!! [&]

                 V
  !▒▒▒▒▒▒▒.▒.▒▒▒&▒▒▒▒
  |||||||||1|||||||||2
  12345678901234567890
+--------------------------------------------------+
  Lives:  1  | Treasures:  1  |  Moves Remaining:  6
+--------------------------------------------------+
Next Move [1-20]: 20

===============> [$] $$$ Found Treasure! $$$ [$]

                    V
  !▒▒▒▒▒▒▒.▒.▒▒▒&▒▒▒▒$
  |||||||||1|||||||||2
  12345678901234567890
+--------------------------------------------------+
  Lives:  1  | Treasures:  2  |  Moves Remaining:  5
+--------------------------------------------------+
Next Move [1-20]: 8

===============> Dope! You've been here before!

         V
  !▒▒▒▒▒▒▒.▒.▒▒▒&▒▒▒▒$
```

```
  |||||||||1|||||||||2
  12345678901234567890
+--------------------------------------------------+
  Lives:  1  | Treasures:  2  |  Moves Remaining:  5
+--------------------------------------------------+
Next Move [1-20]: 3

===============> [$] $$$ Found Treasure! $$$ [$]

    V
  !▒$▒▒▒▒.▒.▒▒▒▒&▒▒▒▒$
  |||||||||1|||||||||2
  12345678901234567890
+--------------------------------------------------+
  Lives:  1  | Treasures:  3  |  Moves Remaining:  4
+--------------------------------------------------+
Next Move [1-20]: 5

===============> [!] !!! BOOOOOM !!! [!]

No more LIVES remaining!

      V
  !▒$▒!▒▒.▒.▒▒▒▒&▒▒▒▒$
  |||||||||1|||||||||2
  12345678901234567890
+--------------------------------------------------+
  Lives:  0  | Treasures:  3  |  Moves Remaining:  3
+--------------------------------------------------+

##################
#   Game over!   #
##################

You should play again and try to beat your score!
```

## Reflection (50%)

Instructions

- Create a text file named "**reflect.txt**"
- Record your answer in the reflect.txt file for each of the following:

1. Describe the benefits and advantages of using user-defined types (structures) in this workshop. You must explain your answer using an example from this workshop.
2. If we enhanced this workshop to keep a history of games played including the endgame results, briefly describe what two major logical changes you would have to make to your program to make this possible?
3. What part of this workshop did you spend the most time working on? What did you do to overcome your difficulties?

**Academic Integrity**

**It is a violation of academic policy to copy content from the course notes or any other published source (including websites, work from another student, or sharing your work with others).**

**Failure to adhere to this policy will result in the filing of a violation report to the Academic Integrity Committee.**

## Part-2 Submission

1. Upload your source file "**w5p2.c**" to your matrix account
2. Upload your reflection file "**reflect.txt**" to your matrix account (to the same directory)
3. Login to matrix in an SSH terminal and change directory to where you placed your workshop source code.
4. Manually compile and run your program to make sure everything works properly:
   ```
   gcc -Wall w5p2.c -o w1 <ENTER>
   ```
   *If there are no error/warnings are generated, execute it:* ***w5*** *<ENTER>*
5. Run the submission command below (replace **profname.proflastname** with **your professors** Seneca userid and replace **NAA** with your section):
   ```
   ~profName.proflastname/submit 144w5/NAA_p2 <ENTER>
   ```
6. Follow the on-screen submission instructions