

Introduction to C++ Programming Project

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Please note that properly naming your submitted files is crucial.

1. Submit the solution for **Project** using the filename:
project.cpp
character.h
character.cpp

Each homework problem is accompanied by a gray box that illustrates the exact format for the sample input and output. It is crucial for you to understand that when you submit your homework, only the input and output values should appear in the console. Do not include additional prompts or messages like “Please enter the x coordinate” or anything else.

For this project, you are **only allowed** to use the following C++ standard libraries:

```
#include <iostream>
#include <string>
#include <vector>
#include <cmath>
```

Using any other libraries or headers is **not permitted** for this specific assignment. Our autograder checks and detects any use of unauthorized libraries, and if detected, you will automatically receive a score of 0 for this assignment.

All the figures are generated using Microsoft Designer and Midjourney using the instructor account.

It is **mandatory** to use the functions provided in `helper.cpp` for generating scenarios. This practice is mandatory to ensure consistency and accuracy in your work, particularly regarding formatting details like commas, spaces, double colons, and similar elements. The `helper.cpp` file contains predefined functions that have been carefully designed to standardize these aspects, thereby eliminating any inconsistencies or errors that might arise from manual coding.

Ensure that you strictly adhere to using these functions for all relevant tasks in Homework 6. Failure to comply may result in discrepancies in your work, which could affect the evaluation of your assignments.

Note that the use of `class` is **mandatory**, not optional.

Your assignment must include a `class` to define a character. This class should at least encompass both `private` and `public` members, as discussed in our recent classes.

Ensure that your class is appropriately defined in both `character.h` and `character.cpp` files. The structure and implementation should align with what we covered in class.

In your `main` function, you **must** utilize this class to create instances of the character.

The Western Movie Scenario Simulator

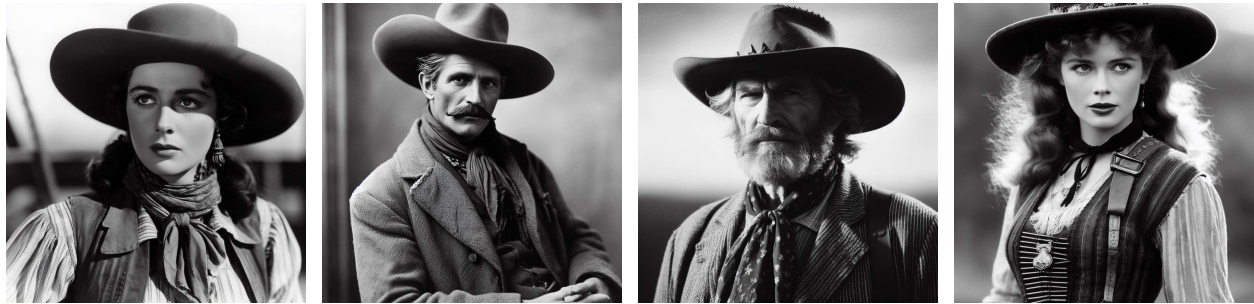


Figure 1: The four main characters of this Western Movie, from left to right: Mattie Ross, William Munny, Rooster Cogburn, and Belle Starr

Background

Set in Los Angeles, a renowned Hollywood company is in the process of writing a screenplay for a Western movie. However, a disagreement between the producer and director regarding certain scenario details has arisen. To resolve this, they have decided to hire you, a skilled programmer, to assist in organizing various possible scenarios.

Scenario Overview

In the movie, there are four characters Mattie Ross, William Munny, Rooster Cogburn, and Belle Starr. These characters discover the existence of a hidden treasure and embark on a joint journey to find it. However, the path to the treasure is fraught with challenges and unexpected events.

Your Task

You are to program the details of these scenarios. Each character possesses a distinct quantity of gold, silver, and bronze coins, as well as different types of guns, which can be Colt Frontier, Bisley, or Colt Buntline. As the characters travel, they must expend coins for various actions and engage in duels with each other. In keeping with the tragic essence of Western movies, it is possible that some characters might be killed.

Rules and Specifications

Coins Allocation

- Each character starts with a specific number of gold, silver, and bronze coins.
- Table 1 details the number of coins for each character, calculated as a function of n , where n is a positive integer greater than 3 (i.e., $n > 3$), and represents the input to your problem.

Weapon Assignment

The type of gun each character possesses is determined by their gold coins.

- If the remainder of gold coins divided by 3 equals 0, the character has a Colt Frontier-type gun.
- If it equals 1, the character has a Bisley-type gun.
- If it equals 2, the character is equipped with a Colt Buntline-type gun.

Journey to the Treasure

- The treasure is located 800 steps away from the starting point.
- All characters begin their journey from step 0.

Movie Rounds

- The movie unfolds over 2000 rounds.
- Each round can involve multiple actions, including movement, coin expenditure, and duels.

Movement Rules

1. Basic Movement Mechanics

- In each round, a character may move toward the treasure. However, movement is contingent on the character's ability to pay with coins.
- The type of coin used for movement determines the number of steps a character can advance:
 - Paying 1 gold coin allows a move of 3 steps forward.
 - Paying 2 silver coins allows a move of 2 steps forward.
 - Paying 3 bronze coins allows a move of 1 step forward.

2. Order of Movement

- At each round, movement permissions are granted sequentially, not simultaneously. The order of movement at each round is as follows: first Character Mattie Ross, then William Munny, followed by Rooster Cogburn, and finally Belle Starr.
- This sequential movement means that when a character considers moving, the actions taken by the preceding characters in the same round are already in effect. For example, when character Rooster Cogburn prepares to move, the coin counts and positions of characters Mattie Ross and William Munny have already been updated based on their actions in the same round. This dynamic requires characters to make movement decisions based on the most current state of the movie.

3. Decision Criteria for Coin Usage

- A character must choose the type of coin based on their holdings relative to other characters.
- The chosen coin type should be one that the character has in an amount equal to or greater than that of at least two other characters (if all are alive).
 - If multiple coin types meet this criterion, the character should use the coin of higher value, with gold being the most valuable, followed by silver, then bronze.
 - If multiple coin types meet the criterion, the character should use the coin of higher value, with gold being the most valuable, followed by silver, then bronze. However, if the character does not have enough of a particular coin type, such as only one silver coin, then the character can move based on the next valuable type that meets this criterion (a very rare condition, though).
- If a character doesn't have a sufficient quantity of any coin type as per these rules, they cannot move in that round.

4. Scenarios with Fewer Characters (due to duels)

- If only three characters remain (i.e., a character has been killed by another one in a duel), movement is based on owning more or an equal number of a particular coin type compared to at least one other character.
- If only two characters remain (i.e., two characters have been killed in duels, there is no need for comparison with the other character's coin holdings for movement. And the choice is based on the coin of higher value.

5. Coin Quantity Restrictions

- Characters cannot have a negative number of coins.
- A character must have a sufficient number of coins for the chosen movement type (e.g., at least 3 bronze coins for a bronze coin-based move).

Duel Rules

1. Timing and Conditions for Duels

- Duels occur at the end of every 100 rounds (i.e., at rounds 100, 200, 300, etc.).
- A duel can only happen if there are more than two characters still alive in the movie. If only two characters are left, no further duels occur.

2. Selection of Duel Participants

- The duel takes place between the two characters who are furthest behind in their journey toward the treasure (i.e., the two characters with the lowest number of steps compared to the others).

- If there is a tie among three characters for the lowest number of steps, no duel occurs in that round.
- If there are four characters alive and, in terms of their position rankings, the second and third characters occupy the same location, then no duel occurs.
- If out of four characters, three remain alive and the two characters who are ahead of the others in terms of the number of steps are in the same position, then no duel happens.

3. Outcome of the Duel

- If the dueling characters have the same type of gun, neither character is killed, reflecting the dramatic conventions of a Western movie.
- If the characters have different types of guns, the character with the less powerful gun is the victim and is killed in the duel.
- The power hierarchy of the guns can be described as follows. Colt Buntline has the greatest power, followed by Bisley, which is more powerful than Colt Frontier. In other words, Colt Frontier is the least powerful, Bisley is more powerful than Colt Frontier, and Colt Buntline is the most powerful of the three.

Ending The Western Movie

1. Ending Condition - Reaching the Treasure

- The movie concludes when a character first reaches the treasure, located at the position of 800 steps.
- If a character's movement takes them beyond 800 steps (e.g., to 802 steps), the movie still ends as the character has effectively reached the treasure.

2. Single Champion Rule

- Due to the sequential nature of the movement (characters do not move simultaneously), there can only be one champion who reaches the treasure first.

3. No Champion Scenarios

- The movie might end without any champion if all characters run out of coins and cannot pay for further movement.
- The movie also concludes with no champion if the maximum number of rounds (2000) is reached and no character has attained the 800 steps needed to reach the treasure.

Input Specification

1. The input to your code is a single positive integer number greater than 3, denoted as n and $n > 3$.
2. This number n will be used to determine various initial conditions and parameters within the movie, such as the number of coins each character starts with and the type of weapons.

Output Specification

Your code should be capable of generating detailed scenarios as envisioned by the hypothetical producers and directors of this Western movie. However, for the purpose of testing and evaluating your code, you are expected to report specifically on two critical outcomes: the results of duels and the final outcome of the movie.

1. Output Specification for Duels

- The output of your code should report the result of each duel, but only in cases where there is a murder and a victim.
- The format for reporting a duel should be as follows. Ensure that your output is presented as a single, unbroken sentence. The only exception is at the very end of the sentence, where you should use a line break (i.e., `endl`) to properly terminate the output.

In the rugged landscape of this Western movie, a dramatic duel unfolds. [Victim's Name], armed with [Victim's Gun Type], and holding [Victim's Number of Gold Coins] gold coins, [Victim's Number of Silver Coins] silver coins, and [Victim's Number of Bronze Coins] bronze coins, faces a grim fate at the hands of [Murderer's Name], wielding the superior [Murderer's Gun Type]. At this pivotal moment, [Murderer's Name] stands with [Murderer's Number of Gold Coins] gold coins, [Murderer's Number of Silver Coins] silver coins, and [Murderer's Number of Bronze Coins] bronze coins. The aftermath of this duel paints a vivid picture of the harsh West: [Victim's Name] falls at step [Victim's Position], their journey ending amidst the dust and echoes of gunshots, while [Murderer's Name], at step [Murderer's Position], carries the heavy burden of survival, weighed down by both their spoils and the cost of their actions.

2. Output Specification for End of Movie

The output of your code should report the end of this Western movie.

- If there is a champion, the format for reporting the end of the movie should be as follows. Ensure that your output is presented as a single, unbroken sentence. The only exception is at the very end of the sentence, where you should use a line break (i.e., `endl`) to properly terminate the output.

In the vast, sunbaked expanse of the Wild West, a solitary figure emerges victorious against all odds. [Champion's Name] standing triumphant at the position of [Champion's Position], clutches the elusive treasure. With [Champion's Number of Gold Coins] gold coins jingling in their pocket, [Champion's Number of Silver Coins] silver coins shimmering in the sunlight, and [Champion's Number of Bronze Coins] bronze coins bearing the weight of their journey, [Champion's Name] stands resolute, their trusty [Champion's Gun Type] gun by their side. This moment marks not just the end of a treacherous path but the beginning of a legend, as [Champion's Name] etches their name in the annals of the West as the undisputed winner of the treasure.

- If there is no champion, the format for reporting the end of the movie should be as follows. Ensure that your output is presented as a single, unbroken sentence. The only exception is at the very end of the sentence, where you should use a line break (i.e., `endl`) to properly terminate the output.

As the dust settles over the rugged landscape, the sun dips below the horizon, casting long shadows over a tale of unfulfilled ambitions and dreams. This is the end of the movie, where the harsh reality rings clear: no one could reach the treasure. The quest that drove our characters through relentless challenges ends not with the triumph of victory but with the quiet of unclaimed fortunes, leaving the treasure still buried in the heart of the West, a silent witness to the trials and tribulations of those who dared to seek it.

	Mattie Ross	William Munny	Rooster Cogburn	Belle Starr
Number of gold coins	$3n^2 - 5n - 14$	$3n^2 - 5n - 13$	$3n^2 - 5n - 11$	$3n^2 - 5n - 10$
Number of silver coins	$3n^2 - 4n + 13$	$3n^2 - 8n + 12$	$3n^2 - 9n + 11$	$3n^2 - 7n - 10$
Number of bronze coins	$3n^2 + 11n + 11$	$3n^2 + 9n + 8$	$3n^2 + 8n + 14$	$3n^2 + 6n - 17$

Table 1: The number of coins for each character, calculated as a function of n

Policy: You **must** utilize **classes** in your C++ programming. **Classes** offer a perfect way to encapsulate the diverse attributes of each character—such as coin counts, gun types, and positional data—into a single, manageable unit. This approach not only aligns well with real-world programming practices but also helps in simulating the complex dynamics of our Western movie scenario. As explained at the beginning of this documentation, you must define `character.h` and `character.cpp`. For example, you can define `character.h` as follows:

```
#ifndef CHARACTER_H
#define CHARACTER_H
```



```
#include <iostream>
#include <string>
using namespace std;

class Character{

    private:
        string name;
        int gold_coin;
        int silver_coin;
        int bronze_coin;
        string weapon_type;
        int step ;
        bool live ;

        // ... and any other private members you wish

    public:
        Character(string Name, int Gold, int Silver, int Bronze);
        void setWeaponType();
        void updatePosition();
        void updateLifeStatus();
        int getGoldCoinNumber();

        // ... and any other public members you wish
};

#endif
```

You can also define `character.cpp` as follows:

```
#include "character.h"

Character :: Character(string Name, int Gold, int Silver, int Bronze){
    // ...
}

void Character :: setWeaponType(){
    // ...
}

int Character :: getGoldCoinNumber(){
    // ...
}
```

```
}

// ... and any other required implementation
```

Beyond leveraging `classes` for data organization, it's advantageous to further modularize your code by implementing functions. Functions allow you to break down the assignment's complex tasks into smaller, more manageable parts. Each function can be designed to handle a specific aspect of the movie logic, taking relevant data from your `classes` as input. For example, you could create a function to determine which characters are eligible for a duel and to determine the result of the duel, such as

```
void duel(Character &A, Character &B, Character &C, Character &D){
    // ...
}
```

Please use the following functions to generate scenarios based on the problem assumptions

```
void generateNarrativeOfDuel(Character Victim, Character Murderer){
    // You must use the predefined function provided in helper.cpp
}
```

```
void generateNarrativeOfChampion(Character A){
    // You must use the predefined function provided in helper.cpp
}
```

```
void generateNarrativeOfNoChampion()(){
    // You must use the predefined function provided in helper.cpp
}
```

Here are some input/output samples.

Sample Input:

5

Sample Output:

```
As the dust settles over the rugged landscape, the sun dips below the
  ↪ horizon, casting long shadows over a tale of unfulfilled
  ↪ ambitions and dreams. This is the end of the movie, where the
  ↪ harsh reality rings clear: no one could reach the treasure. The
  ↪ quest that drove our characters through relentless challenges
  ↪ ends not with the triumph of victory but with the quiet of
  ↪ unclaimed fortunes, leaving the treasure still buried in the
  ↪ heart of the West, a silent witness to the trials and
  ↪ tribulations of those who dared to seek it.
```

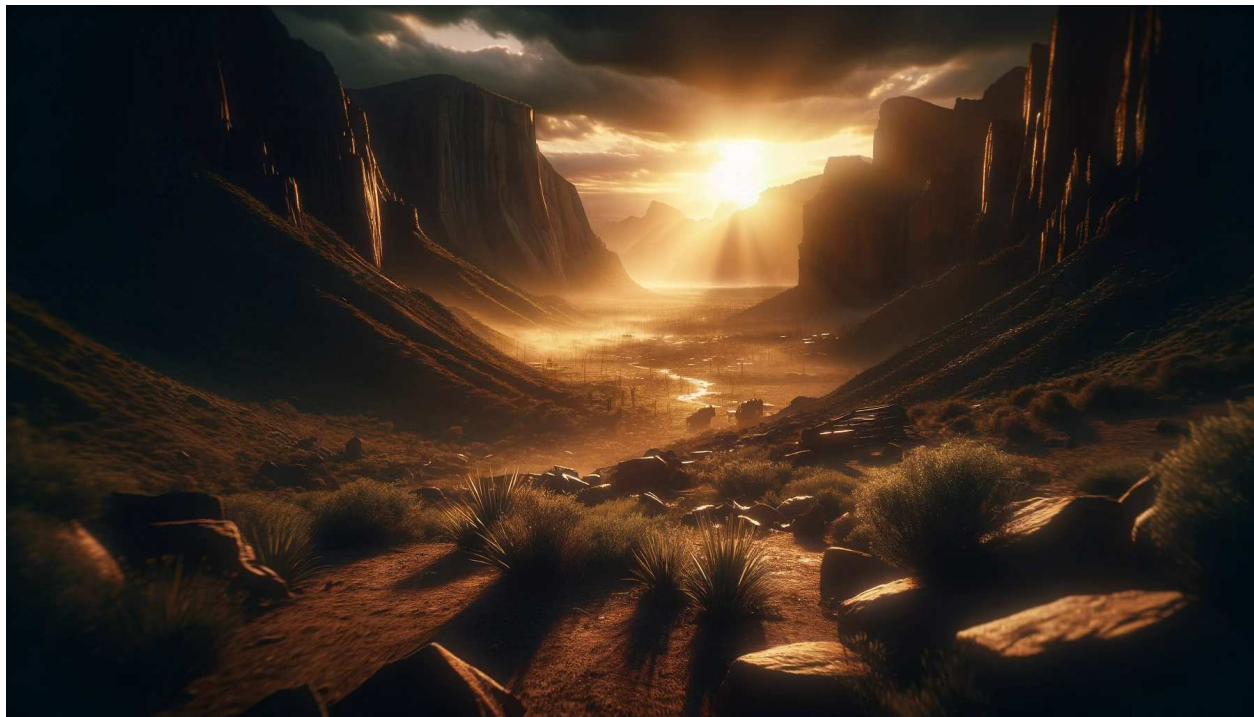


Figure 2: As the dust settles over the rugged landscape, the sun dips below the horizon. This is the end of the Western movie, where the harsh reality rings clear: no one could reach the treasure.

Sample Input:

6

Sample Output:

In the rugged landscape of this Western movie, a dramatic duel unfolds.

↪ Mattie Ross, armed with Bisley, and holding 0 gold coins, 25
↪ silver coins, and 185 bronze coins, faces a grim fate at the
↪ hands of Belle Starr, wielding the superior Colt Buntline. At
↪ this pivotal moment, Belle Starr stands with 0 gold coins, 0
↪ silver coins, and 127 bronze coins. The aftermath of this duel
↪ paints a vivid picture of the harsh West: Mattie Ross falls at
↪ step 264, their journey ending amidst the dust and echoes of
↪ gunshots, while Belle Starr, at step 260, carries the heavy
↪ burden of survival, weighed down by both their spoils and the
↪ cost of their actions.

In the rugged landscape of this Western movie, a dramatic duel unfolds.

↪ Rooster Cogburn, armed with Bisley, and holding 0 gold coins, 1
↪ silver coins, and 2 bronze coins, faces a grim fate at the
↪ hands of Belle Starr, wielding the superior Colt Buntline. At
↪ this pivotal moment, Belle Starr stands with 0 gold coins, 0
↪ silver coins, and 1 bronze coins. The aftermath of this duel
↪ paints a vivid picture of the harsh West: Rooster Cogburn falls
↪ at step 321, their journey ending amidst the dust and echoes of
↪ gunshots, while Belle Starr, at step 302, carries the heavy
↪ burden of survival, weighed down by both their spoils and the
↪ cost of their actions.

As the dust settles over the rugged landscape, the sun dips below the

↪ horizon, casting long shadows over a tale of unfulfilled
↪ ambitions and dreams. This is the end of the movie, where the
↪ harsh reality rings clear: no one could reach the treasure. The
↪ quest that drove our characters through relentless challenges
↪ ends not with the triumph of victory but with the quiet of
↪ unclaimed fortunes, leaving the treasure still buried in the
↪ heart of the West, a silent witness to the trials and
↪ tribulations of those who dared to seek it.

Sample Input:

9

Sample Output:

In the rugged landscape of this Western movie, a dramatic duel unfolds.

↪ Mattie Ross, armed with Bisley, and holding 87 gold coins, 214
↪ silver coins, and 353 bronze coins, faces a grim fate at the
↪ hands of William Munny, wielding the superior Colt Buntline. At
↪ this pivotal moment, William Munny stands with 87 gold coins,
↪ 179 silver coins, and 332 bronze coins. The aftermath of this
↪ duel paints a vivid picture of the harsh West: Mattie Ross falls
↪ at step 297, their journey ending amidst the dust and echoes of
↪ gunshots, while William Munny, at step 298, carries the heavy
↪ burden of survival, weighed down by both their spoils and the
↪ cost of their actions.

In the rugged landscape of this Western movie, a dramatic duel unfolds.

↪ Rooster Cogburn, armed with Bisley, and holding 0 gold coins,
↪ 147 silver coins, and 329 bronze coins, faces a grim fate at the
↪ hands of William Munny, wielding the superior Colt Buntline. At
↪ this pivotal moment, William Munny stands with 0 gold coins,
↪ 153 silver coins, and 332 bronze coins. The aftermath of this
↪ duel paints a vivid picture of the harsh West: Rooster Cogburn
↪ falls at step 587, their journey ending amidst the dust and
↪ echoes of gunshots, while William Munny, at step 585, carries
↪ the heavy burden of survival, weighed down by both their spoils
↪ and the cost of their actions.

In the vast, sunbaked expanse of the Wild West, a solitary figure

↪ emerges victorious against all odds. William Munny standing
↪ triumphant at the position of 800, clutches the elusive treasure
↪ . With 0 gold coins jingling in their pocket, 1 silver coins
↪ shimmering in the sunlight, and 143 bronze coins bearing the
↪ weight of their journey, William Munny stands resolute, their
↪ trusty Colt Buntline gun by their side. This moment marks not
↪ just the end of a treacherous path but the beginning of a legend
↪ , as William Munny etches their name in the annals of the West
↪ as the undisputed winner of the treasure.



Figure 3: In the vast, sunbaked expanse of the Wild West, Belle Starr emerges victorious against all odds.

Sample Input:

10

Sample Output:

In the rugged landscape of this Western movie, a dramatic duel unfolds.

↪ William Munny, armed with Colt Frontier, and holding 139 gold
↪ coins, 228 silver coins, and 398 bronze coins, faces a grim fate
↪ at the hands of Mattie Ross, wielding the superior Colt
↪ Buntline. At this pivotal moment, Mattie Ross stands with 139
↪ gold coins, 267 silver coins, and 421 bronze coins. The
↪ aftermath of this duel paints a vivid picture of the harsh West:
↪ William Munny falls at step 298, their journey ending amidst
↪ the dust and echoes of gunshots, while Mattie Ross, at step 297,
↪ carries the heavy burden of survival, weighed down by both
↪ their spoils and the cost of their actions.

In the vast, sunbaked expanse of the Wild West, a solitary figure
↪ emerges victorious against all odds. Belle Starr standing
↪ triumphant at the position of 800, clutches the elusive treasure
↪ . With 0 gold coins jingling in their pocket, 140 silver coins
↪ shimmering in the sunlight, and 343 bronze coins bearing the
↪ weight of their journey, Belle Starr stands resolute, their
↪ trusty Colt Frontier gun by their side. This moment marks not
↪ just the end of a treacherous path but the beginning of a legend
↪ , as Belle Starr etches their name in the annals of the West as
↪ the undisputed winner of the treasure.



Figure 4: In this Western movie, a dramatic duel unfolds. William Munny, armed with Colt Frontier, faces a grim fate at the hands of Mattie Ross, wielding the superior Colt Buntline.

Sample Input:

25

Sample Output:

In the rugged landscape of this Western movie, a dramatic duel unfolds.

→ William Munny, armed with Colt Frontier, and holding 1639 gold
→ coins, 1687 silver coins, and 2102 bronze coins, faces a grim
→ fate at the hands of Mattie Ross, wielding the superior Colt
→ Buntline. At this pivotal moment, Mattie Ross stands with 1639
→ gold coins, 1782 silver coins, and 2161 bronze coins. The
→ aftermath of this duel paints a vivid picture of the harsh West:
→ William Munny falls at step 296, their journey ending amidst
→ the dust and echoes of gunshots, while Mattie Ross, at step 297,
→ carries the heavy burden of survival, weighed down by both
→ their spoils and the cost of their actions.

In the vast, sunbaked expanse of the Wild West, a solitary figure
→ emerges victorious against all odds. Rooster Cogburn standing
→ triumphant at the position of 801, clutches the elusive treasure
→ . With 1472 gold coins jingling in their pocket, 1661 silver
→ coins shimmering in the sunlight, and 2089 bronze coins bearing
→ the weight of their journey, Rooster Cogburn stands resolute,
→ their trusty Colt Buntline gun by their side. This moment marks
→ not just the end of a treacherous path but the beginning of a
→ legend, as Rooster Cogburn etches their name in the annals of
→ the West as the undisputed winner of the treasure.



Figure 5: Rooster Cogburn standing triumphant, clutches the elusive treasure.

Sample Input:

55

Sample Output:

In the rugged landscape of this Western movie, a dramatic duel unfolds.

→ William Munny, armed with Colt Frontier, and holding 8689 gold
→ coins, 8647 silver coins, and 9572 bronze coins, faces a grim
→ fate at the hands of Mattie Ross, wielding the superior Colt
→ Buntline. At this pivotal moment, Mattie Ross stands with 8689
→ gold coins, 8862 silver coins, and 9691 bronze coins. The
→ aftermath of this duel paints a vivid picture of the harsh West:
→ William Munny falls at step 296, their journey ending amidst
→ the dust and echoes of gunshots, while Mattie Ross, at step 297,
→ carries the heavy burden of survival, weighed down by both
→ their spoils and the cost of their actions.

In the vast, sunbaked expanse of the Wild West, a solitary figure
→ emerges victorious against all odds. Rooster Cogburn standing
→ triumphant at the position of 801, clutches the elusive treasure
→ . With 8522 gold coins jingling in their pocket, 8591 silver
→ coins shimmering in the sunlight, and 9529 bronze coins bearing
→ the weight of their journey, Rooster Cogburn stands resolute,
→ their trusty Colt Buntline gun by their side. This moment marks
→ not just the end of a treacherous path but the beginning of a
→ legend, as Rooster Cogburn etches their name in the annals of
→ the West as the undisputed winner of the treasure.