CS2100 Final project

Due Friday, December 6th, end of day.
Early submission due Tuesday, December 4th end of day

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BE SURE ALL FILES ARE SUBMITTED. If we don't have all files necessary to run your project, we cannot grade it.

NO LATE SUBMISSIONS WILL BE ACCEPTED

For the core functionality of this game (not the extra credit), only concepts taught in this class are permitted.

You will write a complete 2-player game of Yahtzee using the provided design. Good programming style, documentation, including javadocs and inline comments, will be graded.

If you are unfamiliar with the game, I would encourage you to find an online implementation to try out.

On the following pages you will find the required classes for this project. Failure to adhere to this UML will result in point deduction.   Programs with significant deviation will not be graded.

Sample runs have been provided. It is expected that you will accept user input as demonstrated in the sample runs. When prompted for a move, the only valid options are "roll", "score" or an integer between 1 and 5. Input should be case insensitive. **this is the format of user input your code will be tested with**

Error handling:

Using any combination of good programming practices and exception handling, your program should be robust. We will try to break it ☺ Do not assume the user will follow directions.

YAHTZEE

Yahtzee is a popular multi-player dice game. The objective is to maximize your score by rolling five dice to make certain combinations.   A game consists of 13 rounds, with each player getting one turn in each round. Each player's turn consists of an initial roll of all 5 dice, followed by up to 2 additional rolls. Before making a second or third roll, a player can opt to 'save' dice that will not be re-rolled, or 'unsave' dice.

Each player has a score card.

The score card has 13 possible scoring categories with an associated description and weight, plus a Yahtzee bonus count (0 to 3). More complete descriptions are listed below.

At the end of a turn, a player must choose to score a category on their scorecard. This category cannot be chosen again in this game. This ends the player's turn.

Scoring

Upper section

- **Ones :** Receive 1 point for each 1 rolled
- **Twos :** Receive 2 points for each 2 rolled
- **Threes :** Receive 3 points for each 3 rolled
- **Fours :** Receive 4 points for each 4 rolled
- **Fives :** Receive 5 points for each 5 rolled
- **Sixes** : Receive 6 points for each 6 rolled

Lower section

- **Three of a Kind**
  If there are three dice of the same number, add up all the spots on *all* the dice
- **Four of a Kind**
  If there are four dice of the same number, add up all the spots on *all* the dice
- **Full House** Three dice showing the same number, and two dice showing another number, scores 25 points.
- **Small Straight** Any four consecutive numbers (for example, 3-4-5-6), scores 30 points
  Large Straight Any five consecutive numbers (for example, 2-3-4-5-6), scores 40 points
- **Yahtzee (or Five of a Kind)** All 5 dice showing the same number, scores 50 points (see note below)
- **Chance** Any combination of dice, add up all the spots on all the dice

It's possible that a player will end up with a combination of dice that could be used in more than one category. For example, a roll of 3-3-3-4-4 could be scored as threes or fours in the Upper Section, or as a Full House or a Three-Of-A-Kind, or Chance in the Lower Section. The player has the option of scoring the dice in any one of those categories as long as they have not been used previously in the game.

If a player's final roll does not score points for any remaining category, they must choose a category with a score of 0, and that category cannot be used again.

Yahtzee Bonus

If a player rolls a Yahtzee on their turn *and* they have already filled in the Yahtzee category (but did not zero it) in a previous turn, they receive a Yahtzee bonus. If the player throws a Yahtzee but have filled the Yahtzee category with a score of 0, they do not get a Yahtzee bonus. The player should select the Yahtzee category for each Yahtzee. At the end of the game, each Yahtzee bonus is worth 100 points. Scoring a Yahtzee bonus constitutes a complete turn.

Source (https://www.dicegamedepot.com/yahtzee-rules/)

Required classes

The following classes must be used. A detailed description of each class follows.

You may add private methods to your classes, but you may not change the public interface.
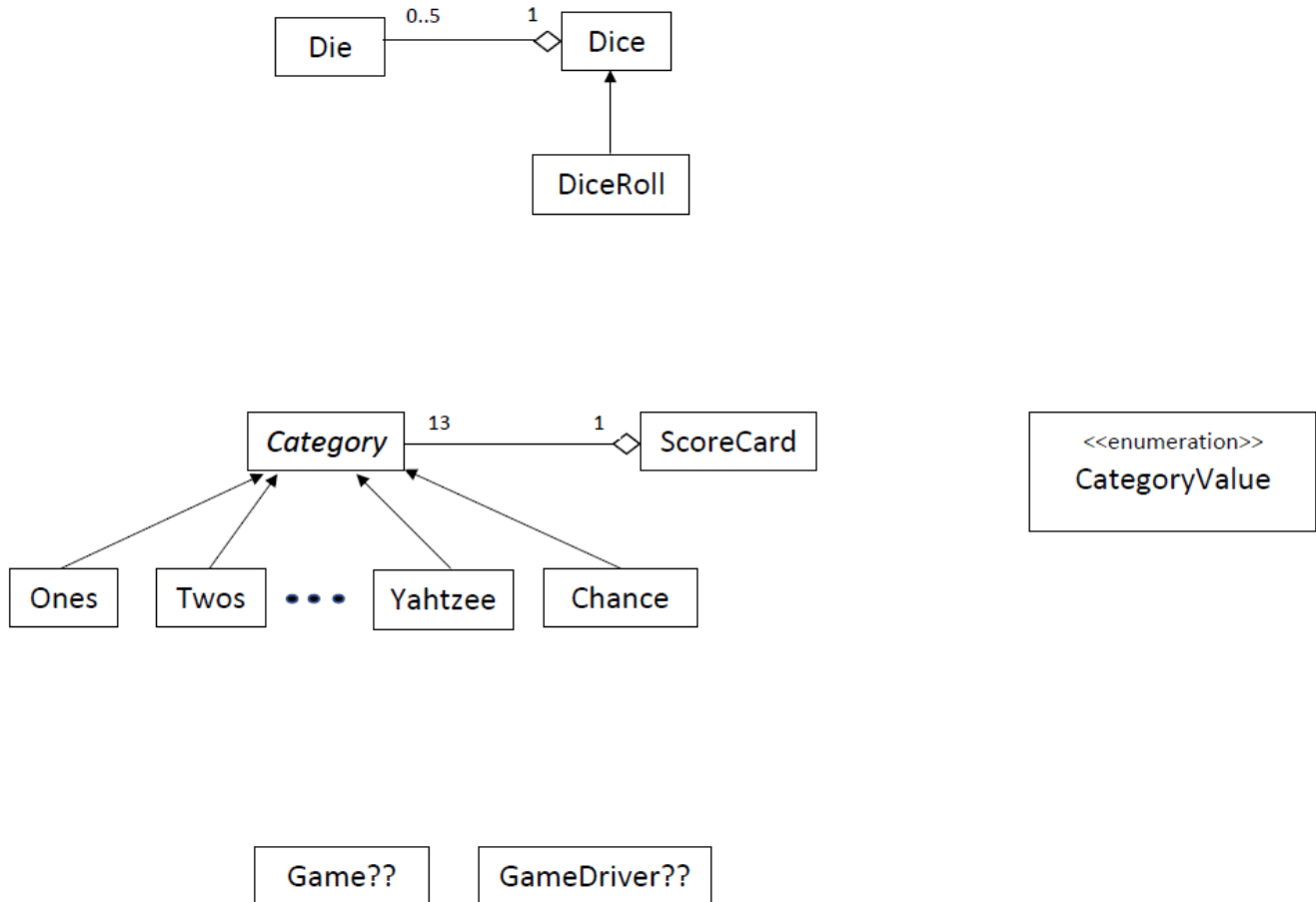
<<enumeration>> CategoryValue		
Constant	**value**	**name**
ONES	0	"Ones"
TWOS	1	"Twos"
THREES	2	"Threes"
FOURS	3	"Fours"
FIVES	4	"Fives"
SIXES	5	"Sixes"
THREE_OF_A_KIND	6	"Three of a Kind"
FOUR_OF_A_KIND	7	"Four of a Kind"
FULL_HOUSE	8	"Full House"
SM_STRAIGHT	9	"Small Straight"
LG_STRAIGHT	10	"Large Straight"
YAHTZEE	11	"Yahtzee"
CHANCE	12	"Chance"
- CategoryValue(int v, String n)	Create an enumerated type with specified name and value	
+ getValue( ) : int	Return value for CategoryValue	
+ toString( ) : String	Return name for CategoryValue	

A full implementation of `CategoryValue` is provided later in this document.

Die A single die	
- value : int	The value on the die
- SIDES : int	Number of sides on the die (class constant). For our application this is 6.
- r: Random	One random number generator for all Die to share (class variable)
+ Die( )	Initialize value to a random number between 1 and SIDES
+ roll( ) : void	Change the value on the die to a random value between 1 and SIDES
+ getValue( ) : int	Return value on die
+ toString( ) : String	A String containing single integer value representing the value on the die

Dice	
An initially empty container to add Die objects to	
– dice : ArrayList<Die>	A container for Die objects
– DEF CAP : int	The default initial capacity of the ArrayList. For our application this is 5.
+ Dice( )	Create the ArrayList with DEF_CAP capacity
+ Dice(num : int)	Create the ArrayList with num capacity
+ addDie(d : Die) : void	Add the d to the end of the ArrayList
+ getNumDice( ) :int	Return the number of Die in the ArrayList
+ getDie(i : int) : Die	Return the Die at index i in the ArrayList.
+ removeDie(i: int) : Die	Remove the Die at the index i in the ArrayList
+ count(val : int) : int	Return the number of Die in the ArrayList that have a value of the specified val
+ sum( ) :int	Return the sum of the Die values in the ArrayList
+ contains(val : int) : boolean	Return true if at least one Die in the ArrayList has a value of val
+ toString( ) : String	For each Die in the ArrayList, index and value, for example: 1: value 5

DiceRoll is-a **Dice**	
A specialization of the Dice class that allows tossing (rolling all the Die in the collection)	
– NUM DIE : int	The number of Die that we will roll and add to the Dice object. For our application this is 5.
+ DiceRoll( )	Fill the super (Dice) object with NUM_DIE random Die objects
+ toss( ) : void	+ roll each of the Die in the Dice ArrayList

Ones is-a **Category**	
The category for "ones" on the score card"	
+ evaluate (Dice d) : int	Evaluates the Die in the Dice object and return a score that would be achieved for this category

Twos, Threes, Fours, Fives, Sixes, ThreeOfAKind, FourOfAKind, FullHouse, SmStraight, LgStraight, FiveOfAKind, and Chance all extend Category and override the evaluate method as demonstrated with the Ones class.

Category	
An <u>abstract</u> base class for all categories on the score card.	
– score : int	The current score for this category
– used : boolean	Has this category been used?
+ evaluate (d: Dice): int	An abstract method that will evaluate the Die in the Dice object and return a score
+ addValue (d : Dice) : void	Add the value the Dice would produce to the score (calls evaluate). Marks category as used.
+ getScore ( ) : int	Return current score for this category
+ getUsed ( ) : boolean	Returns value of used indicating if category has been used.

Note: evaluate is the only abstract method, all other methods are implemented in Category.

ScoreCard	
The collection of categories, as well as scores of top/bottom and total	
`- ArrayList<Category> scorecard`	The collection of Category objects
`- yahtzeeBonus : int`	Initially 0, incremented by 1 for each Yahtzee rolled after first Yahtzee. Up to 3 allowed.
`- NUM CATS : int`	The number of categories = 13
`+ Scorecard( )`	Create all Category objects and add to the ArrayList.
`+ choose(cv : CategoryValue, d : Dice) : void`	Use cv to get the appropriate Category and score that category.
`+ getEvaluation(cv:CategoryValue,d:Dice) : int`	Return the score that would be achieved in this category with the provided Dice object
`+ checkScored( cv : CategoryValue ) : boolean`	Return true if Category has been used, false otherwise
`+ getCategoryScore( cv : CategoryValue ) : int`	Return the current score for the specified Category
`+ scoreTop( ) : int`	Return the total score for the top of the scorecard (see provided score card)
`+ scoreBottom( ) : int`	Return the total score for the bottom of the scorecard (see provided score card)
`+ score ( ) : int`	Return the total score for the scorecard (see provided score card)
`+ toString( ) : String`	See sample run of program

CategoryValue – enumerated type

```java
/**
   A Collection of values.  Each element in collection has a value and a name
*/
public enum CategoryValue {

    ONES(0, "Ones"), TWOS(1, "Twos"), THREES(2, "Threes"),
    FOURS(3, "Fours"), FIVES(4, "Fives"), SIXES(5, "Sixes"),
    THREE_OF_A_KIND(6, "Three of a Kind"), FOUR_OF_A_KIND(7, "Four of a Kind"),
    FULL_HOUSE(8, "Full House"),  SM_STRAIGHT(9, "Small Straight"),
    LG_STRAIGHT(10, "Large Straight"), YAHTZEE(11, "Yahtzee"),
    CHANCE(12, "Chance");

    private final int value;
    private final String name;

    /**
      Constructor that specifies value and name
      @param v the value
      @param n the name
    */
    private CategoryValue(int v, String n) {
        value = v;
        name = n;
    }
    /**
       Get the value of the CategoryValue
       @return value of the CategoryValue
    */
    public int getValue() {
        return value;
    }
    /**
      return a String representation of CategoryValue
      @return the name (a String
    */
    @Override
    public String toString() {
        return name;
    }

}
```

Sample use:

```java
        CategoryValue cv = CategoryValue.ONES;
        System.out.println(cv.getValue());
        System.out.println(cv); // invokes toString
```

Would produce the output:

```
0
Ones
```

Game and `GameDriver`

Using the required classes, use your best OOP skills to create the `Game` class that plays the game and `GameDriver` which kicks off the game. You will be graded on design. As a hint, your `main` method should be only a few lines for code. For example:

```
Game g = new Game();
g.playGame();
```

Notes:

- When taking a turn, a player is given only 3 valid choices
    - an integer between 1 and 5: the integer value will toggle the 'saved' status of an individual die
    - roll: roll only the dice not saved. After the initial roll presented, the player may only choose 'roll' twice.
    - score: will allow the player to score the current die. This ends a turn. If the player is out of rolls, they are forced to score.

- The user is always presented with their current scorecard indicating the current score/value for each category.

- When the user scores, they are only presented with categories that are available to choose.

- Once all players have taken thirteen turns (and subsequently filled in all the categories on their score card) the game ends.

- When scoring, if a player scores a grand total of 63 or more points in the Upper Section by the end of the game, they receive a 35-point bonus.

- Some rules force the player to choose a category on the top half of the score sheet, if possible. We will not enforce this.

Tips and Tricks

- In your `Die` class, you will need to create a `Random` object:

  ```
  private static Random r = new Random( );
  ```

  If you don't specify a seed for the random number generator, the time of day is used and a different sequence will be generated each time you start the game (that's a good thing). For debugging purposes, it is helpful to initially generate the same sequence each time you run the program. To specify a seed, you provide a value to the Random constructor:

  ```
  private static Random r = new Random(1);
  ```

  Be sure to remove this integer to completely test your program.

- Your `Dice` class has a `count( )` method that will count the number of occurrences of a die value in the collection. `dice.count(1)` will tell you how many 1s are in your set of dice. This will be helpful in determining the value for categories (ones..sixes, three of a kind, four of a kind, Yahtzee).

- Your `Dice` class has a `contains` method that determines if your 5 dice contain at least one of the specified value. `dice.contains(4)` will return true if at least one die has a value of 4. A small straight must contain a 3 and 4. Besides the 3 and 4, it could contain 1 & 2, 2 & 5 or 5 & 6. A similar approach works for large straight, as well.

  In the `Game` class you will need to keep track of whether each die is saved or not. Initially none are saved. One option is to keep an array of 5 boolean values representing the 5 die values in your `Dice` object. If a player toggles from saved to unsaved or vice versa, you toggle the corresponding value in the boolean array.
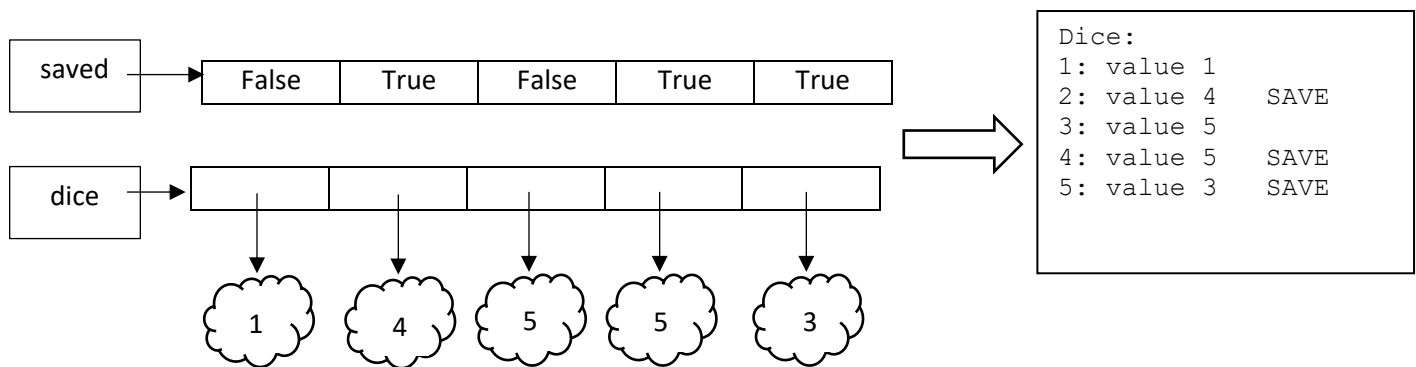
- You will be using CategoryValue enumerated type extensively. Remember, it's just a collection of constants with some additional functionality. To iterate through the collection, you can use a for loop:

  ```
  for (CategoryValue cv: CategoryValue.values())
  ```

  and to test a `CategoryValue` variable, you can use ==

  ```
  if ( cv == CategoryValue.YAHTZEE )
  ```

Sample runs have been included at the end of this document.

Grading – the project will be graded out of 150 points (153 possible)

Design and Implementation of classes		
Die class	5	As specified by UML
Dice class	10	As specified by UML
DiceRoll class	5	As specified by UML
Category class	5	As specified by UML
Individual Category classes x 13	13	As specified by UML
ScoreCard class	10	As specified by UML
Game class	20	Using good OOP principles, design and implement these two classes.
Game Driver class		
Functionality		
Allow 13 turns for each player	5	Don't count invalid user input as choice. Only allow 2 re-rolls.
Display of Scorecard	5	Display at before each roll.
Display of dice	5	Initial roll, then saved/not saved dice
Get user input for choice of action	10	Validate
Process user input	5	Appropriate action taken
Save dice	10	Separate chosen dice from dice to be rolled
"roll" action	5	Roll the dice not saved
"score" action	10	Present possible available categories. Validate choice. Update Scorecard.
Documentation and Style		
Headers on all files	5	
Inline comments, as needed	5	
Javadocs on all methods	10	
Reasonable style within code	10	

Extra credit -- *to be eligible for extra credit, the core functionality must be completed. You must make a clearly visible note in the comments at the top of GameDriver class indicating the extra credit you would like to be evaluated for.*

Early Submission (submit by Tuesday, December 5th)	10
In addition to Game and GameDriver, implement a Player class. At a minimum, a Player has-a ScoreCard and a name. Use Player in your Game class.	10
Instead of just a 2 person player vs player game, implement a computer vs player game.	20

Excerpts from Sample Runs
#1

```
********************************************************
                   WELCOME TO YAHTZEE
********************************************************


*** Player 1: ***
Current Scorecard:
           Ones: 0
           Twos: 0
         Threes: 0
          Fours: 0
          Fives: 0
          Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
      Full House: 0
  Small Straight: 0
  Large Straight: 0
         Yahtzee: 0
          Chance: 0
  Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 0
           Total: 0

****************************

Dice:
1: value 1
2: value 1
3: value 4
4: value 2
5: value 1

Please select a die # to toggle it between save and unsave, "roll" or "score": 7
7 is not a valid die value
Current Scorecard:
           Ones: 0
           Twos: 0
         Threes: 0
          Fours: 0
          Fives: 0
          Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
      Full House: 0
  Small Straight: 0
  Large Straight: 0
         Yahtzee: 0
          Chance: 0
  Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 0
           Total: 0

****************************

Dice:
```

```
1: value 1
2: value 1
3: value 4
4: value 2
5: value 1

Please select a die # to toggle it between save and unsave, "roll" or "score": adfd
adfd is not a valid die value
Current Scorecard:
              Ones: 0
              Twos: 0
            Threes: 0
             Fours: 0
             Fives: 0
             Sixes: 0
   Three of a Kind: 0
    Four of a Kind: 0
        Full House: 0
    Small Straight: 0
    Large Straight: 0
           Yahtzee: 0
            Chance: 0
   Yahtzee bonus:: 0
       Upper Total: 0
       Lower Total: 0
             Total: 0

****************************

Dice:
1: value 1
2: value 1
3: value 4
4: value 2
5: value 1

Please select a die # to toggle it between save and unsave, "roll" or "score": 1
Current Scorecard:
              Ones: 0
              Twos: 0
            Threes: 0
             Fours: 0
             Fives: 0
             Sixes: 0
   Three of a Kind: 0
    Four of a Kind: 0
        Full House: 0
    Small Straight: 0
    Large Straight: 0
           Yahtzee: 0
            Chance: 0
   Yahtzee bonus:: 0
       Upper Total: 0
       Lower Total: 0
             Total: 0

****************************

Dice:
1: value 1    SAVE
2: value 1
3: value 4
4: value 2
```

```
5: value 1

Please select a die # to toggle it between save and unsave, "roll" or "score": 2
Current Scorecard:
              Ones: 0
              Twos: 0
            Threes: 0
             Fours: 0
             Fives: 0
             Sixes: 0
   Three of a Kind: 0
    Four of a Kind: 0
        Full House: 0
    Small Straight: 0
    Large Straight: 0
           Yahtzee: 0
            Chance: 0
    Yahtzee bonus:: 0
       Upper Total: 0
       Lower Total: 0
             Total: 0

****************************

Dice:
1: value 1   SAVE
2: value 1   SAVE
3: value 4
4: value 2
5: value 1

Please select a die # to toggle it between save and unsave, "roll" or "score": 5
Current Scorecard:
              Ones: 0
              Twos: 0
            Threes: 0
             Fours: 0
             Fives: 0
             Sixes: 0
   Three of a Kind: 0
    Four of a Kind: 0
        Full House: 0
    Small Straight: 0
    Large Straight: 0
           Yahtzee: 0
            Chance: 0
    Yahtzee bonus:: 0
       Upper Total: 0
       Lower Total: 0
             Total: 0

****************************

Dice:
1: value 1   SAVE
2: value 1   SAVE
3: value 4
4: value 2
5: value 1   SAVE

Please select a die # to toggle it between save and unsave, "roll" or "score": roll
Current Scorecard:
              Ones: 0
```

```
         Twos: 0
       Threes: 0
        Fours: 0
        Fives: 0
        Sixes: 0
Three of a Kind: 0
 Four of a Kind: 0
    Full House: 0
 Small Straight: 0
 Large Straight: 0
       Yahtzee: 0
        Chance: 0
 Yahtzee bonus:: 0
    Upper Total: 0
    Lower Total: 0
         Total: 0

****************************

Dice:
1: value 1   SAVE
2: value 1   SAVE
3: value 3
4: value 3
5: value 1   SAVE

Please select a die # to toggle it between save and unsave, "roll" or "score": score
Select a category that you have not scored in yet:
 1: Ones, 3 points
 2: Twos, 0 points
 3: Threes, 6 points
 4: Fours, 0 points
 5: Fives, 0 points
 6: Sixes, 0 points
 7: Three of a Kind, 9 points
 8: Four of a Kind, 9 points
 9: Full House, 25 points
10: Small Straight, 0 points
11: Large Straight, 0 points
12: Yahtzee, 0 points
13: Chance, 9 points
9
You scored 25 points in Full House

*** Player 2: ***
Current Scorecard:
          Ones: 0
          Twos: 0
        Threes: 0
         Fours: 0
         Fives: 0
         Sixes: 0
Three of a Kind: 0
 Four of a Kind: 0
    Full House: 0
 Small Straight: 0
 Large Straight: 0
       Yahtzee: 0
        Chance: 0
 Yahtzee bonus:: 0
    Upper Total: 0
    Lower Total: 0
         Total: 0
```

```
*****************************

Dice:
1: value 5
2: value 1
3: value 3
4: value 3
5: value 2

Please select a die # to toggle it between save and unsave, "roll" or "score": score
Select a category that you have not scored in yet:
 1: Ones, 1 points
 2: Twos, 2 points
 3: Threes, 6 points
 4: Fours, 0 points
 5: Fives, 5 points
 6: Sixes, 0 points
 7: Three of a Kind, 0 points
 8: Four of a Kind, 0 points
 9: Full House, 0 points
10: Small Straight, 0 points
11: Large Straight, 0 points
12: Yahtzee, 0 points
13: Chance, 14 points
3
You scored 6 points in Threes

*** Player 1: ***
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
      Full House: 25
  Small Straight: 0
  Large Straight: 0
         Yahtzee: 0
          Chance: 0
  Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 25
           Total: 25

*****************************

Dice:
1: value 4
2: value 3
3: value 6
4: value 1
5: value 4

Please select a die # to toggle it between save and unsave, "roll" or "score": score
Select a category that you have not scored in yet:
 1: Ones, 1 points
 2: Twos, 0 points
 3: Threes, 3 points
 4: Fours, 8 points
```

```
 5: Fives, 0 points
 6: Sixes, 6 points
 7: Three of a Kind, 0 points
 8: Four of a Kind, 0 points
10: Small Straight, 30 points
11: Large Straight, 0 points
12: Yahtzee, 0 points
13: Chance, 18 points
9
Please enter a category you have not scored yet
Select a category that you have not scored in yet:
 1: Ones, 1 points
 2: Twos, 0 points
 3: Threes, 3 points
 4: Fours, 8 points
 5: Fives, 0 points
 6: Sixes, 6 points
 7: Three of a Kind, 0 points
 8: Four of a Kind, 0 points
10: Small Straight, 30 points
11: Large Straight, 0 points
12: Yahtzee, 0 points
13: Chance, 18 points
4
You scored 8 points in Fours

*** Player 2: ***
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 6
           Fours: 0
           Fives: 0
           Sixes: 0
  Three of a Kind: 0
   Four of a Kind: 0
       Full House: 0
   Small Straight: 0
   Large Straight: 0
          Yahtzee: 0
           Chance: 0
  Yahtzee bonus:: 0
     Upper Total: 6
     Lower Total: 0
           Total: 6

*****************************

Dice:
1: value 6
2: value 5
3: value 5
4: value 1
5: value 5

Please select a die # to toggle it between save and unsave, "roll" or "score":
 ----jGRASP: process ended by user.

 ----jGRASP exec: java GameDriver
*******************************************************
                   WELCOME TO YAHTZEE
*******************************************************
```

```
*** Player 1: ***
Current Scorecard:
             Ones: 0
             Twos: 0
           Threes: 0
            Fours: 0
            Fives: 0
            Sixes: 0
  Three of a Kind: 0
   Four of a Kind: 0
       Full House: 0
   Small Straight: 0
   Large Straight: 0
          Yahtzee: 0
           Chance: 0
   Yahtzee bonus:: 0
      Upper Total: 0
      Lower Total: 0
            Total: 0

****************************

Dice:
1: value 5
2: value 3
3: value 5
4: value 5
5: value 5

Please select a die # to toggle it between save and unsave, "roll" or "score": 1
Current Scorecard:
             Ones: 0
             Twos: 0
           Threes: 0
            Fours: 0
            Fives: 0
            Sixes: 0
  Three of a Kind: 0
   Four of a Kind: 0
       Full House: 0
   Small Straight: 0
   Large Straight: 0
          Yahtzee: 0
           Chance: 0
   Yahtzee bonus:: 0
      Upper Total: 0
      Lower Total: 0
            Total: 0

****************************

Dice:
1: value 5    SAVE
2: value 3
3: value 5
4: value 5
5: value 5

Please select a die # to toggle it between save and unsave, "roll" or "score": 3
Current Scorecard:
             Ones: 0
             Twos: 0
```

```
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
      Full House: 0
  Small Straight: 0
  Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 0
           Total: 0

****************************

Dice:
1: value 5    SAVE
2: value 3
3: value 5    SAVE
4: value 5
5: value 5

Please select a die # to toggle it between save and unsave, "roll" or "score": 4
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
      Full House: 0
  Small Straight: 0
  Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 0
           Total: 0

****************************

Dice:
1: value 5    SAVE
2: value 3
3: value 5    SAVE
4: value 5    SAVE
5: value 5

Please select a die # to toggle it between save and unsave, "roll" or "score": 5
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
 Three of a Kind: 0
```

```
 Four of a Kind: 0
     Full House: 0
 Small Straight: 0
 Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 0
           Total: 0


****************************

Dice:
1: value 5   SAVE
2: value 3
3: value 5   SAVE
4: value 5   SAVE
5: value 5   SAVE

Please select a die # to toggle it between save and unsave, "roll" or "score": roll
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
      Full House: 0
 Small Straight: 0
 Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 0
           Total: 0


****************************

Dice:
1: value 5   SAVE
2: value 2
3: value 5   SAVE
4: value 5   SAVE
5: value 5   SAVE

Please select a die # to toggle it between save and unsave, "roll" or "score": roll


Out of rolls, you must score

Dice:
1: value 5
2: value 2
3: value 5
4: value 5
5: value 5
```

```
Select a category that you have not scored in yet:
 1: Ones, 0 points
 2: Twos, 2 points
 3: Threes, 0 points
 4: Fours, 0 points
 5: Fives, 20 points
 6: Sixes, 0 points
 7: Three of a Kind, 22 points
 8: Four of a Kind, 22 points
 9: Full House, 0 points
10: Small Straight, 0 points
11: Large Straight, 0 points
12: Yahtzee, 0 points
13: Chance, 22 points
8
You scored 22 points in Four of a Kind

*** Player 2: ***
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
      Full House: 0
  Small Straight: 0
  Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 0
           Total: 0

****************************

Dice:
1: value 2
2: value 4
3: value 1
4: value 5
5: value 3

Please select a die # to toggle it between save and unsave, "roll" or "score": score
Select a category that you have not scored in yet:
 1: Ones, 1 points
 2: Twos, 2 points
 3: Threes, 3 points
 4: Fours, 4 points
 5: Fives, 5 points
 6: Sixes, 0 points
 7: Three of a Kind, 0 points
 8: Four of a Kind, 0 points
 9: Full House, 0 points
10: Small Straight, 30 points
11: Large Straight, 40 points
12: Yahtzee, 0 points
13: Chance, 15 points
11
You scored 40 points in Large Straight
```

```
*** Player 1: ***
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
Three of a Kind: 0
 Four of a Kind: 22
     Full House: 0
 Small Straight: 0
 Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 22
           Total: 22

*****************************

Dice:
1: value 1
2: value 1
3: value 6
4: value 3
5: value 3

Please select a die # to toggle it between save and unsave, "roll" or "score": 4
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
Three of a Kind: 0
 Four of a Kind: 22
     Full House: 0
 Small Straight: 0
 Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 22
           Total: 22

*****************************

Dice:
1: value 1
2: value 1
3: value 6
4: value 3    SAVE
5: value 3

Please select a die # to toggle it between save and unsave, "roll" or "score": 5
Current Scorecard:
            Ones: 0
            Twos: 0
```

```
       Threes: 0
        Fours: 0
        Fives: 0
        Sixes: 0
Three of a Kind: 0
 Four of a Kind: 22
    Full House: 0
 Small Straight: 0
 Large Straight: 0
       Yahtzee: 0
        Chance: 0
 Yahtzee bonus:: 0
    Upper Total: 0
    Lower Total: 22
         Total: 22

****************************

Dice:
1: value 1
2: value 1
3: value 6
4: value 3   SAVE
5: value 3   SAVE

Please select a die # to toggle it between save and unsave, "roll" or "score": roll
Current Scorecard:
          Ones: 0
          Twos: 0
        Threes: 0
         Fours: 0
         Fives: 0
         Sixes: 0
Three of a Kind: 0
 Four of a Kind: 22
    Full House: 0
 Small Straight: 0
 Large Straight: 0
       Yahtzee: 0
        Chance: 0
 Yahtzee bonus:: 0
    Upper Total: 0
    Lower Total: 22
         Total: 22

****************************

Dice:
1: value 5
2: value 6
3: value 3
4: value 3   SAVE
5: value 3   SAVE

Please select a die # to toggle it between save and unsave, "roll" or "score": 3
Current Scorecard:
          Ones: 0
          Twos: 0
        Threes: 0
         Fours: 0
         Fives: 0
         Sixes: 0
Three of a Kind: 0
```

```
  Four of a Kind: 22
     Full House: 0
 Small Straight: 0
 Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 22
          Total: 22


****************************

Dice:
1: value 5
2: value 6
3: value 3    SAVE
4: value 3    SAVE
5: value 3    SAVE

Please select a die # to toggle it between save and unsave, "roll" or "score": roll


Out of rolls, you must score

Dice:
1: value 6
2: value 5
3: value 3
4: value 3
5: value 3



Select a category that you have not scored in yet:
 1: Ones, 0 points
 2: Twos, 0 points
 3: Threes, 9 points
 4: Fours, 0 points
 5: Fives, 5 points
 6: Sixes, 6 points
 7: Three of a Kind, 20 points
 9: Full House, 0 points
10: Small Straight, 0 points
11: Large Straight, 0 points
12: Yahtzee, 0 points
13: Chance, 20 points
3
You scored 9 points in Threes

*** Player 2: ***
Current Scorecard:
           Ones: 0
           Twos: 0
         Threes: 0
          Fours: 0
          Fives: 0
          Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
     Full House: 0
 Small Straight: 0
 Large Straight: 40
```

```
        Yahtzee: 0
         Chance: 0
 Yahtzee bonus:: 0
    Upper Total: 0
    Lower Total: 40
          Total: 40

****************************

Dice:
1: value 6
2: value 4
3: value 3
4: value 2
5: value 5

Please select a die # to toggle it between save and unsave, "roll" or "score": score
Select a category that you have not scored in yet:
 1: Ones, 0 points
 2: Twos, 2 points
 3: Threes, 3 points
 4: Fours, 4 points
 5: Fives, 5 points
 6: Sixes, 6 points
 7: Three of a Kind, 0 points
 8: Four of a Kind, 0 points
 9: Full House, 0 points
10: Small Straight, 30 points
12: Yahtzee, 0 points
13: Chance, 20 points
10
You scored 30 points in Small Straight

*** Player 1: ***
Current Scorecard:
           Ones: 0
           Twos: 0
         Threes: 9
          Fours: 0
          Fives: 0
          Sixes: 0
Three of a Kind: 0
 Four of a Kind: 22
     Full House: 0
 Small Straight: 0
 Large Straight: 0
        Yahtzee: 0
         Chance: 0
 Yahtzee bonus:: 0
    Upper Total: 9
    Lower Total: 22
          Total: 31

****************************

Dice:
1: value 1
2: value 5
3: value 6
4: value 4
5: value 4

Please select a die # to toggle it between save and unsave, "roll" or "score": 4
```

```
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 9
           Fours: 0
           Fives: 0
           Sixes: 0
Three of a Kind: 0
 Four of a Kind: 22
      Full House: 0
 Small Straight: 0
 Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 9
     Lower Total: 22
           Total: 31

****************************

Dice:
1: value 1
2: value 5
3: value 6
4: value 4    SAVE
5: value 4

Please select a die # to toggle it between save and unsave, "roll" or "score": 5
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 9
           Fours: 0
           Fives: 0
           Sixes: 0
Three of a Kind: 0
 Four of a Kind: 22
      Full House: 0
 Small Straight: 0
 Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 9
     Lower Total: 22
           Total: 31

****************************

Dice:
1: value 1
2: value 5
3: value 6
4: value 4    SAVE
5: value 4    SAVE

Please select a die # to toggle it between save and unsave, "roll" or "score": roll
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 9
           Fours: 0
```

```
           Fives: 0
           Sixes: 0
Three of a Kind: 0
 Four of a Kind: 22
     Full House: 0
 Small Straight: 0
 Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 9
     Lower Total: 22
           Total: 31

****************************

Dice:
1: value 1
2: value 4
3: value 3
4: value 4   SAVE
5: value 4   SAVE

Please select a die # to toggle it between save and unsave, "roll" or "score": score
Select a category that you have not scored in yet:
 1: Ones, 1 points
 2: Twos, 0 points
 4: Fours, 12 points
 5: Fives, 0 points
 6: Sixes, 0 points
 7: Three of a Kind, 16 points
 9: Full House, 0 points
10: Small Straight, 30 points
11: Large Straight, 0 points
12: Yahtzee, 0 points
13: Chance, 16 points
5
You scored 0 points in Fives

*** Player 2: ***
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
Three of a Kind: 0
 Four of a Kind: 0
     Full House: 0
 Small Straight: 30
 Large Straight: 40
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 70
           Total: 70

****************************

Dice:
1: value 2
```

```
2: value 3
3: value 2
4: value 4
5: value 4

Please select a die # to toggle it between save and unsave, "roll" or "score":
```

Sample Run #2 – A look at error handling
```
*******************************************************
                  WELCOME TO YAHTZEE
*******************************************************



*** Player 1: ***
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
      Full House: 0
  Small Straight: 0
  Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 0
           Total: 0

****************************

Dice:
1: value 1
2: value 1
3: value 4
4: value 2
5: value 1

Please select a die # to toggle it between save and unsave, "roll" or "score": 7
7 is not a valid die value
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
      Full House: 0
  Small Straight: 0
  Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 0
           Total: 0

****************************

Dice:
1: value 1
2: value 1
3: value 4
4: value 2
```

```
5: value 1

Please select a die # to toggle it between save and unsave, "roll" or "score": adfd
adfd is not a valid die value
Current Scorecard:
             Ones: 0
             Twos: 0
           Threes: 0
            Fours: 0
            Fives: 0
            Sixes: 0
   Three of a Kind: 0
    Four of a Kind: 0
       Full House: 0
   Small Straight: 0
   Large Straight: 0
          Yahtzee: 0
           Chance: 0
    Yahtzee bonus:: 0
      Upper Total: 0
      Lower Total: 0
            Total: 0

****************************

Dice:
1: value 1
2: value 1
3: value 4
4: value 2
5: value 1

Please select a die # to toggle it between save and unsave, "roll" or "score": 1
Current Scorecard:
             Ones: 0
             Twos: 0
           Threes: 0
            Fours: 0
            Fives: 0
            Sixes: 0
   Three of a Kind: 0
    Four of a Kind: 0
       Full House: 0
   Small Straight: 0
   Large Straight: 0
          Yahtzee: 0
           Chance: 0
    Yahtzee bonus:: 0
      Upper Total: 0
      Lower Total: 0
            Total: 0

****************************

Dice:
1: value 1    SAVE
2: value 1
3: value 4
4: value 2
5: value 1

Please select a die # to toggle it between save and unsave, "roll" or "score": 2
Current Scorecard:
```

```
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
      Full House: 0
  Small Straight: 0
  Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 0
           Total: 0

****************************

Dice:
1: value 1   SAVE
2: value 1   SAVE
3: value 4
4: value 2
5: value 1

Please select a die # to toggle it between save and unsave, "roll" or "score": 5
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
 Three of a Kind: 0
  Four of a Kind: 0
      Full House: 0
  Small Straight: 0
  Large Straight: 0
         Yahtzee: 0
          Chance: 0
 Yahtzee bonus:: 0
     Upper Total: 0
     Lower Total: 0
           Total: 0

****************************

Dice:
1: value 1   SAVE
2: value 1   SAVE
3: value 4
4: value 2
5: value 1   SAVE

Please select a die # to toggle it between save and unsave, "roll" or "score": roll
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
```

```
        Sixes: 0
Three of a Kind: 0
 Four of a Kind: 0
     Full House: 0
 Small Straight: 0
 Large Straight: 0
        Yahtzee: 0
         Chance: 0
 Yahtzee bonus:: 0
    Upper Total: 0
    Lower Total: 0
          Total: 0


*****************************

Dice:
1: value 1   SAVE
2: value 1   SAVE
3: value 3
4: value 3
5: value 1   SAVE

Please select a die # to toggle it between save and unsave, "roll" or "score": score
Select a category that you have not scored in yet:
 1: Ones, 3 points
 2: Twos, 0 points
 3: Threes, 6 points
 4: Fours, 0 points
 5: Fives, 0 points
 6: Sixes, 0 points
 7: Three of a Kind, 9 points
 8: Four of a Kind, 9 points
 9: Full House, 25 points
10: Small Straight, 0 points
11: Large Straight, 0 points
12: Yahtzee, 0 points
13: Chance, 9 points
9
You scored 25 points in Full House

*** Player 2: ***
Current Scorecard:
           Ones: 0
           Twos: 0
         Threes: 0
          Fours: 0
          Fives: 0
          Sixes: 0
Three of a Kind: 0
 Four of a Kind: 0
     Full House: 0
 Small Straight: 0
 Large Straight: 0
        Yahtzee: 0
         Chance: 0
 Yahtzee bonus:: 0
    Upper Total: 0
    Lower Total: 0
          Total: 0


*****************************

Dice:
```

```
1: value 5
2: value 1
3: value 3
4: value 3
5: value 2

Please select a die # to toggle it between save and unsave, "roll" or "score": score
Select a category that you have not scored in yet:
 1: Ones, 1 points
 2: Twos, 2 points
 3: Threes, 6 points
 4: Fours, 0 points
 5: Fives, 5 points
 6: Sixes, 0 points
 7: Three of a Kind, 0 points
 8: Four of a Kind, 0 points
 9: Full House, 0 points
10: Small Straight, 0 points
11: Large Straight, 0 points
12: Yahtzee, 0 points
13: Chance, 14 points
3
You scored 6 points in Threes

*** Player 1: ***
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 0
           Fours: 0
           Fives: 0
           Sixes: 0
  Three of a Kind: 0
   Four of a Kind: 0
       Full House: 25
   Small Straight: 0
   Large Straight: 0
          Yahtzee: 0
           Chance: 0
  Yahtzee bonus:: 0
      Upper Total: 0
      Lower Total: 25
            Total: 25

****************************

Dice:
1: value 4
2: value 3
3: value 6
4: value 1
5: value 4

Please select a die # to toggle it between save and unsave, "roll" or "score": score
Select a category that you have not scored in yet:
 1: Ones, 1 points
 2: Twos, 0 points
 3: Threes, 3 points
 4: Fours, 8 points
 5: Fives, 0 points
 6: Sixes, 6 points
 7: Three of a Kind, 0 points
 8: Four of a Kind, 0 points
```

```
10: Small Straight, 30 points
11: Large Straight, 0 points
12: Yahtzee, 0 points
13: Chance, 18 points
9
Please enter a category you have not scored yet
Select a category that you have not scored in yet:
 1: Ones, 1 points
 2: Twos, 0 points
 3: Threes, 3 points
 4: Fours, 8 points
 5: Fives, 0 points
 6: Sixes, 6 points
 7: Three of a Kind, 0 points
 8: Four of a Kind, 0 points
10: Small Straight, 30 points
11: Large Straight, 0 points
12: Yahtzee, 0 points
13: Chance, 18 points
4
You scored 8 points in Fours

*** Player 2: ***
Current Scorecard:
            Ones: 0
            Twos: 0
          Threes: 6
           Fours: 0
           Fives: 0
           Sixes: 0
  Three of a Kind: 0
   Four of a Kind: 0
      Full House: 0
  Small Straight: 0
  Large Straight: 0
         Yahtzee: 0
          Chance: 0
  Yahtzee bonus:: 0
     Upper Total: 6
     Lower Total: 0
           Total: 6

*****************************

Dice:
1: value 6
2: value 5
3: value 5
4: value 1
5: value 5

Please select a die # to toggle it between save and unsave, "roll" or "score":
```