
Due Date:	By 11:55pm Friday April 13, 2018
Evaluation:	5% of final mark (see marking rubric at the end of handout)
Late Submission:	none accepted
Purpose:	The purpose of this assignment is to practice defining new types/classes and then using them in your program.
CEAB/CIPS Attributes:	Design/Problem analysis/Communication Skills

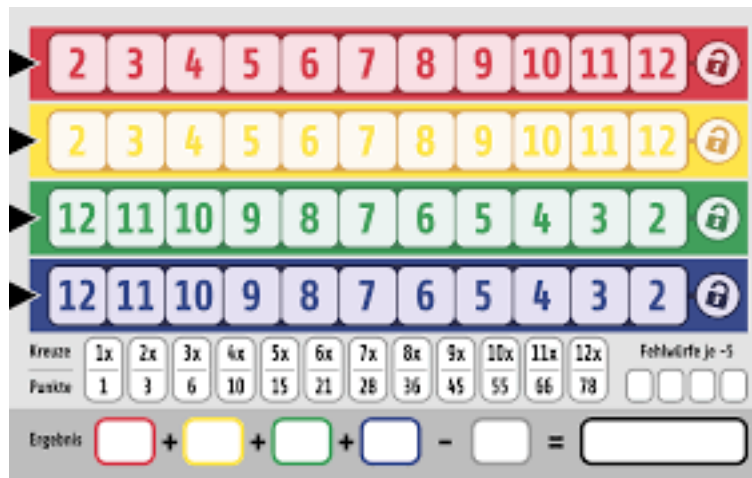
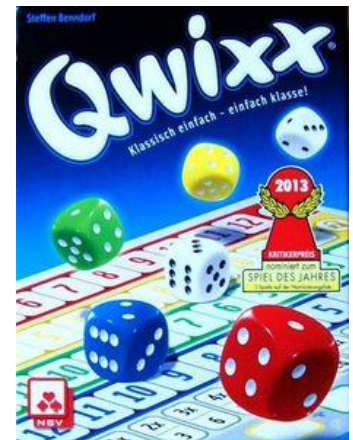
General Guidelines When Writing Programs:

See previous assignments.

Qwixx

You will write a version of the dice game Qwixx.

In this game there are 6 dice, 2 white dice and 4 colour dice: red, yellow, green and blue and each player has a game board as shown below:



The goal of the game is to score as many points as possible. The more numbers you cross off the higher your score. There are 4 rows of numbers, each a different color, and two of them go from 2-12 whereas the other two go from 12-2. The main rule is that you have to start on the left and go to the right — and if you pass up a number, well you're out of luck. In other words, you can mark off a number only if it's to the right of all marked-off numbers in the same row. So, if you marked off say the 2, 3 and 6 on the red row, the next number you can mark is 7 (or higher). You cannot mark off 4 and 5 anymore.

At the start of each new round:

- The player changes (this is now the players who's turn it is).
- The dice are rolled.

- All players can use the total number of the two white dice to cross off that number in any row on their sheet (as long as they follow the ~~right~~ **left** to ~~left~~ **right** rule).
- Next, the player who's turn it is gets to choose a second number to cross off using 1 white dice plus one colored dice. For example, if you had a white 3 and a red 6 you could cross off a 9 in your red row. On your turn you must take a number or take a penalty (worth -5 at the end of the game). Note that there are no penalties for passing on the white dice total.

The game ends when:

- Any 2 of the colour rows have been locked out (by any player crossing off the 12 or 2 at the far right of the score pad) or a player has passed 4 times (i.e. has -20 points).

Scoring to determine the winner:

- At the end of the game you count up how many numbers are crossed off in each row and score accordingly based on the scoring grid shown below in the methods description section.
- Subtract the number of negative points from the total.
- The winner is the player with the most points.

In order to get you started here are the classes, instance variables, and methods you should have.

You will create 4 classes: *Dice*, *Move*, *Player*, and *Qwixx*.

1. Define a *Dice* class:

- A *Dice* object has 2 attributes: a String *colour* and an integer *currentSide*.
- Default constructor which sets the *colour* to white and sets an initial *currentSide* using the *rollDice()* method (see below).
- A constructor that takes one input, a *colour*, and sets an initial *currentSide* using the *rollDice()* method (see below).
- A get/set (mutator/accessor) method for *colour* and a get method for *currentSide*.
- A *toString()* method that returns the colour and current side of the dice as a String.
- A *rollDice()* method which randomly assigns a number between 1 and 6 to *currentSide* and return the result of the roll.**

2. Define a *Move* class:

- A *Move* object has 2 attributes: a character *colour* and an integer *number*.
- Get/set (mutator/accessor) methods for colour and number.
- A constructor that takes two inputs, a colour and a number and sets the attributes accordingly.
- A static methods *convertColourtoNum(char colour)* method that takes a char and converts it to the index of the row for that colour (i.e. 'R' = 0, 'Y' = 1, 'G' = 2, 'B' = 3) and returns that index. This method will help you index the right array element during the game to cross it out.

3. Define a *Player* class:

- A *Player* object has seven attributes: a String *name*, a 2D String[4][11] *gameBoard* (the col will represent the colour (Red, Yellow, Green and Blue), and the row the numbers in that colour row (from 12-2 or 2-12), 4 integers to keep track of the last number that was crossed off in each colour row, and an integer *negativePoints* to keep track of how many negative points they accumulated by passing.
- A default constructor which initializes all of the attributes, the game board should be initialized using the *initializeGameboard()* method described below.
- A constructor which takes one parameter, a String for the player name.
- Accessor/get methods for each of the attributes *except* the game board.
- An *initializeGameboard()* which initializes each row of the gameboard; for Red and Yellow from ~~12-2~~ **2-12** and for Green and Blue from ~~2-12~~ **12-2**.
- An *addNegativePoints(int pts)* method that takes a parameter pts and adds these to the *negativePoints* of the player.
- A *printGameBoard()* method that prints out the player's gameboard (including the name of the player who's board is being printed).
- A *makeMove(Move m)* method, that takes as input a move and crosses off the appropriate colour/number combination on the player's gameboard. *Hint: you may wish to make use of your convertColourtoNum(char colour) method.*
- A *getBoardTotalMethod()* which calculates the total for the gameboard based on the following (the top row is how many numbers are crossed off, the bottom how many points). You should calculate the points per each colour based on how many numbers were crossed off and subtract the player's negative points to get the total.

Kruisjes	1x	2x	3x	4x	5x	6x	7x	8x	9x	10x	11x	12x	Elke mislukte ronde: -5
Punten	1	3	6	10	15	21	28	36	45	55	66	78	

Score		+		+		+		-		=	
-------	--	---	--	---	--	---	--	---	--	---	--

Note: In this version of the game there is no way to score 12 for any given color

4. A Qwixx class:

- The *Qwixx* class is where all the action happens. In this class we have the following attributes: an array of Dice[] that will contain each of the coloured dice and two white dice. An array of Players[] that contains the players in the game, four boolean values that keep track of whether a colour is locked and therefore no longer playable (recall a colour is locked when any player crosses off the 12 or 2 at the far right of the score pad of that colour), a static variable NEGPTS which is set to -5.
- A constructor that takes an array of Players and initializes the Players[] with it. The constructor should also initialize the Dice[].
- The following methods: *rollDice()* which randomly assigns the current side of each of the 6 dice **using the rollDice() method of the Dice class**. A *printRolledDice()* method that prints all of the dice and their current values.
- A *playWhiteDiceMove()* which takes care of the moves on the white dice. Recall that all players can use the total number on the two white dice to cross off a number in any row

on their sheet. This method should print the total of the white dice and ask each player if they would like to use the total to cross off one of the numbers on the game board. If a player wants to make a move, you should create a move, check if it's valid and if it is update the gameboard. For simplicity, you may loop through the players in the same order each time. The method might make use of the following helper methods:

- a. A `getWhiteDiceTotal()` method that returns the sum of the two white dice.
- b. A `checkValidMove(Player p, Move m)` method that checks if the move the player wants to make is valid and returns a boolean indicating whether it is or is not a valid move. Remember a move is valid if it's on the gameboard and if the number being crossed off is further right than the last crossed off number AND the colour has not been unlocked. *Hint: the Player class keeps track of the last crossed off value for each colour on their own gameboard.*
- c. A `checkColourFinished(Player p, Char colour)` method that returns true if the colour the player has just crossed off a number in becomes finished. The method should also update that colour to be locked for the game and output this to the console.
- d. A `checkGameFinished()` method that checks if the game is finished. A game is finished when ~~all~~ **two** of the colour rows have been locked out (by a player crossing off the 12 or 2 at the far right of the score pad) or a player has passed 4 times (i.e. has -20 points).
- e. A `playColourDiceMoves(Player p)` method which takes care of the moves on the colour dice. Recall that the player who's turned it is gets to choose a second number to cross off using 1 white die plus one colored die. This method should ask the player if they want to make a move. If they do, it should ask which white dice they want to use and which colour they want to cross out, create a move based on this, check if it's valid and if so update the gameboard. If they decide not to play, then you should give them -5 points. Again, you may use the helper methods listed above.
- f. A `play()` method which loops calling the `rollDice()`, `printRolledDice()`, `playWhiteDiceMove()`, `playColourDiceMove()`, and `checkGameFinished()` methods until the game is done. Once the game is done use a method (e.g. `determineWinner()`) to determine the winner.

4. A Driver class:

- a. The main method in the driver class should ask the user how many players are playing the game. Ensure this is between 2-5.
- b. For each player ask the user the name and create the player.
- c. Create a *Qwixx* game with the array of players and call the `play()` method.

***Note** although you should check valid moves, you do not have to deal with input mismatch errors.

Here is a sample output to illustrate the expected behavior of your program. Your formatting may differ from the below but must demonstrate the behavior of the game and be easy to follow.

Note: user input is highlighted in yellow. Green is other points of interest in the program.

Please enter the number of players (2-5): 1

You must have between 2 and 5 players.

Please enter the number of players (2-5): 2

Please enter the name of player1: Nancy

Nancy's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 9 8 7 6 5 4 3 2

Blue: 12 11 10 9 8 7 6 5 4 3 2

Please enter the name of player2: Marta

Marta's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 9 8 7 6 5 4 3 2

Blue: 12 11 10 9 8 7 6 5 4 3 2

---- New Round ----

Red dice: 4 | Yellow dice: 4 | Green dice: 1 | Blue dice: 4 | White1 dice: 6 | White2 dice: 3 |

***** Move on white dice *****

The total for the white dice is 9

Nancy it's your turn...

Nancy's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 9 8 7 6 5 4 3 2

Blue: 12 11 10 9 8 7 6 5 4 3 2

Both players move on the white dice.

Would you like to cross off a number on the game board using the white dice total? (anything other than 'yes' is taken to mean no): yes

What colour would you like to cross out? (R = red, Y = yellow, G = green, B = Blue): G

Nancy's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 X 8 7 6 5 4 3 2

Blue: 12 11 10 9 8 7 6 5 4 3 2

***** Move on white dice *****

The total for the white dice is 9

Marta it's your turn...

Marta's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 9 8 7 6 5 4 3 2

Blue: 12 11 10 9 8 7 6 5 4 3 2

Would you like to cross off a number on the game board using the white dice total? (anything other than 'yes' is taken to mean no): yes

What colour would you like to cross out? (R = red, Y = yellow, G = green, B = Blue): B

Marta's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 9 8 7 6 5 4 3 2

Blue: 12 11 10 X 8 7 6 5 4 3 2

Nancy it's your turn...

***** Move on any colour dice *****

Nancy's Gameboard:


Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 X 8 7 6 5 4 3 2

Blue: 12 11 10 9 8 7 6 5 4 3 2

Nancy's turn, only she moves
on the coloured dice



Red dice: 4 | Yellow dice: 4 | Green dice: 1 | Blue dice: 4 | White1 dice: 6 | White2 dice: 3 |

Would you like to cross off a number on the game board using one of the coloured dice and a white dice? (anything other than 'yes' is taken to mean no): **yes**

Which white dice would you like to use? (White = 1, White2 = 2): **1**

What colour would you like to cross out? (R = red, Y = yellow, G = green, B = Blue): **B**

Nancy's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 X 8 7 6 5 4 3 2

Blue: 12 11 X 9 8 7 6 5 4 3 2

----- New Round -----

Red dice: 6 | Yellow dice: 1 | Green dice: 3 | Blue dice: 1 | White1 dice: 6 | White2 dice: 1 |

***** Move on white dice *****

The total for the white dice is 7

Nancy it's your turn...

Nancy's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 X 8 7 6 5 4 3 2

Blue: 12 11 X 9 8 7 6 5 4 3 2

Would you like to cross off a number on the game board using the white dice total? (anything other than 'yes' is taken to mean no): **yes**

What colour would you like to cross out? (R = red, Y = yellow, G = green, B = Blue): **G**

Nancy's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 X 8 X 6 5 4 3 2

Blue: 12 11 X 9 8 7 6 5 4 3 2

***** Move on white dice *****

The total for the white dice is 7

Marta it's your turn...

Marta's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 9 8 7 6 5 4 3 2

Blue: 12 11 10 X 8 7 6 5 4 3 2

Would you like to cross off a number on the game board using the white dice total? (anything other than 'yes' is taken to mean no): **yes**

What colour would you like to cross out? (R = red, Y = yellow, G = green, B = Blue): **B**

Marta's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12

Yellow: 2 3 4 5 6 7 8 9 10 11 12

Green: 12 11 10 9 8 7 6 5 4 3 2

Blue: 12 11 10 X 8 X 6 5 4 3 2

Marta's turn, now she moves
on the coloured dice

Marta it's your turn...

***** Move on any colour dice *****

Marta's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12
Yellow: 2 3 4 5 6 7 8 9 10 11 12
Green: 12 11 10 9 8 7 6 5 4 3 2
Blue: 12 11 10 X 8 X 6 5 4 3 2

Red dice: 6 | Yellow dice: 1 | Green dice: 3 | Blue dice: 1 | White1 dice: 6 | White2 dice: 1 |

Would you like to cross off a number on the game board using one of the coloured dice and a white dice? (anything other than 'yes' is taken to mean no): **yes**

Which white dice would you like to use? (White = 1, White2 = 2): **2**

What colour would you like to cross out? (R = red, Y = yellow, G = green, B = Blue): **Y**

Marta's Gameboard:

Red: 2 3 4 5 6 7 8 9 10 11 12
Yellow: X 3 4 5 6 7 8 9 10 11 12
Green: 12 11 10 9 8 7 6 5 4 3 2
Blue: 12 11 10 X 8 X 6 5 4 3 2

----- New Round -----

Red dice: 4 | Yellow dice: 2 | Green dice: 5 | Blue dice: 4 | White1 dice: 3 | White2 dice: 2 |

... (deleted some moves for brevity)

Nancy it's your turn...

***** Move on any colour dice *****

Nancy's Gameboard:

Red: 2 X 4 5 6 7 8 9 10 11 12
Yellow: 2 3 X 5 6 7 8 9 10 11 12
Green: 12 11 10 X 8 X 6 X 4 X 2
Blue: 12 11 X 9 8 7 6 5 4 3 2

Red dice: 1 | Yellow dice: 5 | Green dice: 5 | Blue dice: 5 | White1 dice: 2 | White2 dice: 1 |

Would you like to cross off a number on the game board using one of the coloured dice and a white dice? (anything other than 'yes' is taken to mean no): **yes**

Which white dice would you like to use? (White = 1, White2 = 2): **2**

What colour would you like to cross out? (R = red, Y = yellow, G = green, B = Blue): **G**

Invalid move 3 is already crossed off in G

Would you like to cross off a number on the game board using one of the coloured dice and a white dice? (anything other than 'yes' is taken to mean no): **yes**

Which white dice would you like to use? (White = 1, White2 = 2): **1**

What colour would you like to cross out? (R = red, Y = yellow, G = green, B = Blue): **B**

Nancy's Gameboard:

Red: 2 X 4 5 6 7 8 9 10 11 12
Yellow: 2 3 X 5 6 7 8 9 10 11 12
Green: 12 11 10 X 8 X 6 X 4 X 2
Blue: 12 11 X 9 8 X 6 5 4 3 2

----- New Round -----

Red dice: 4 | Yellow dice: 1 | Green dice: 5 | Blue dice: 5 | White1 dice: 6 | White2 dice: 5 |

***** Move on white dice *****

The total for the white dice is 11

Nancy it's your turn...

Nancy's Gameboard:

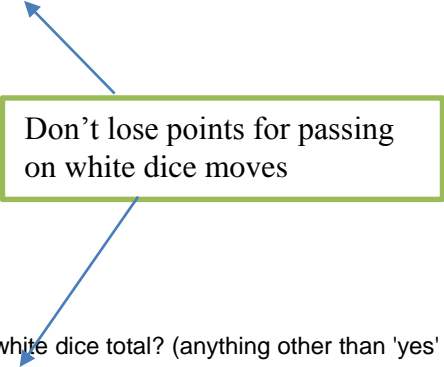
Red: 2 X 4 5 6 7 8 9 10 11 12

Yellow: 2 3 X 5 6 7 8 9 10 11 12
Green: 12 11 10 X 8 X 6 X 4 X 2
Blue: 12 11 X 9 8 X 6 5 4 3 2

Would you like to cross off a number on the game board using the white dice total? (anything other than 'yes' is taken to mean no): **no**

***** Move on white dice *****
The total for the white dice is 11

Marta it's your turn...
Marta's Gameboard:
Red: 2 3 4 5 6 7 8 9 10 11 12
Yellow: X X 4 5 6 7 8 9 10 11 12
Green: 12 11 10 9 8 7 6 5 4 3 2
Blue: 12 11 10 X 8 X 6 X X X 2



Don't lose points for passing
on white dice moves

Would you like to cross off a number on the game board using the white dice total? (anything other than 'yes' is taken to mean no): **no**

Marta it's your turn...

***** Move on any colour dice *****
Marta's Gameboard:
Red: 2 3 4 5 6 7 8 9 10 11 12
Yellow: X X 4 5 6 7 8 9 10 11 12
Green: 12 11 10 9 8 7 6 5 4 3 2
Blue: 12 11 10 X 8 X 6 X X X 2

Red dice: 4 | Yellow dice: 1 | Green dice: 5 | Blue dice: 5 | White1 dice: 6 | White2 dice: 5 |

Would you like to cross off a number on the game board using one of the coloured dice and a white dice? (anything other than 'yes' is taken to mean no): **yes**

Which white dice would you like to you use? (White = 1, White2 = 2): **1**

What colour would you like to cross out? (R = red, Y = yellow, G = green, B = Blue): **G**

Marta's Gameboard:
Red: 2 3 4 5 6 7 8 9 10 11 12
Yellow: X X 4 5 6 7 8 9 10 11 12
Green: 12 X 10 9 8 7 6 5 4 3 2
Blue: 12 11 10 X 8 X 6 X X X 2

... (deleted some moves for brevity)

***** Move on any colour dice *****
Nancy's Gameboard:
Red: 2 X 4 5 X 7 8 9 10 11 12
Yellow: 2 3 X 5 6 X X 9 10 11 12
Green: 12 11 10 X 8 X 6 X 4 X 2
Blue: 12 11 X 9 8 X X 5 4 3 2

Red dice: 1 | Yellow dice: 3 | Green dice: 4 | Blue dice: 5 | White1 dice: 2 | White2 dice: 4 |

Would you like to cross off a number on the game board using one of the coloured dice and a white dice? (anything other than 'yes' is taken to mean no): **no**

For passing you get -5 points. You now have -5 points.

... (deleted some moves for brevity)

***** Move on white dice *****
The total for the white dice is 8

Nancy it's your turn...

Nancy's Gameboard:

Red: 2 X 4 5 X X X X 10 X 12
Yellow: 2 3 X 5 6 X X X 10 11 12
Green: 12 11 10 X 8 X 6 X 4 X 2
Blue: 12 11 X 9 8 X X X X 3 2

Would you like to cross off a number on the game board using the white dice total? (anything other than 'yes' is taken to mean no): **no**

***** Move on white dice *****

The total for the white dice is 8

Marta it's your turn...

Marta's Gameboard:

Red: 2 3 X 5 6 7 8 9 X 11 12
Yellow: X X 4 5 6 X X 9 10 X 12
Green: 12 X 10 9 8 X X 5 4 X 2
Blue: 12 11 10 X 8 X 6 X X X 2

Would you like to cross off a number on the game board using the white dice total? (anything other than 'yes' is taken to mean no): **no**

Marta it's your turn...

***** Move on any colour dice *****

Marta's Gameboard:

Red: 2 3 X 5 6 7 8 9 X 11 12
Yellow: X X 4 5 6 X X 9 10 X 12
Green: 12 X 10 9 8 X X 5 4 X 2
Blue: 12 11 10 X 8 X 6 X X X 2

Red dice: 1 | Yellow dice: 6 | Green dice: 2 | Blue dice: 6 | White1 dice: 6 | White2 dice: 2 |

Would you like to cross off a number on the game board using one of the coloured dice and a white dice? (anything other than 'yes' is taken to mean no): **yes**

Which white dice would you like to you use? (White = 1, White2 = 2): **1**

What colour would you like to cross out? (R = red, Y = yellow, G = green, B = Blue): **Y**

Marta's Gameboard:

Red: 2 3 X 5 6 7 8 9 X 11 12
Yellow: X X 4 5 6 X X 9 10 X X
Green: 12 X 10 9 8 X X 5 4 X 2
Blue: 12 11 10 X 8 X 6 X X X 2

Yellow is no longer playable. Player Marta has locked it.

... (deleted some moves for brevity)

***** Move on any colour dice *****

Nancy's Gameboard:

Red: 2 X 4 5 X X X X 10 X 12
Yellow: 2 3 X 5 6 X X X 10 11 12
Green: 12 11 10 X 8 X 6 X 4 X 2
Blue: 12 11 X 9 8 X X X X 3 2

Red dice: 5 | Yellow dice: 5 | Green dice: 5 | Blue dice: 2 | White1 dice: 2 | White2 dice: 4 |

Would you like to cross off a number on the game board using one of the coloured dice and a white dice? (anything other than 'yes' is taken to mean no): **no**

For passing you get -5 points. You now have -15 points.

----- New Round -----

Red dice: 4 | Yellow dice: 4 | Green dice: 3 | Blue dice: 2 | White1 dice: 6 | White2 dice: 5 |

***** Move on white dice *****
The total for the white dice is 11

Nancy it's your turn...

Nancy's Gameboard:

Red: 2 X 4 5 X X X X 10 X 12
Yellow: 2 3 X 5 6 X X X 10 11 12
Green: 12 11 10 X 8 X 6 X 4 X 2
Blue: 12 11 X 9 8 X X X X 3 2

Would you like to cross off a number on the game board using the white dice total? (anything other than 'yes' is taken to mean no): **yes**

What colour would you like to cross out? (R = red, Y = yellow, G = green, B = Blue): **Y**

Can't move on Yellow, it's locked.

Would you like to cross off a number on the game board using the white dice total? (anything other than 'yes' is taken to mean no): **no**

... (deleted some moves for brevity)

Would you like to cross off a number on the game board using the white dice total? (anything other than 'yes' is taken to mean no): **no**

Nancy it's your turn...

***** Move on any colour dice *****

Nancy's Gameboard:

Red: 2 X 4 5 X X X X 10 X 12
Yellow: 2 3 X 5 6 X X X 10 11 12
Green: 12 11 10 X 8 X 6 X 4 X 2
Blue: 12 11 X 9 8 X X X X 3 2

Red dice: 4 | Yellow dice: 3 | Green dice: 2 | Blue dice: 4 | White1 dice: 4 | White2 dice: 3 |

Would you like to cross off a number on the game board using one of the coloured dice and a white dice? (anything other than 'yes' is taken to mean no): **no**

For passing you get -5 points. You now have -20 points.

Nancy has a total of: 36 points.

Marta has a total of: 47 points.

That's all folks! Marta wins the game!

Submitting Assignment 4

Please check your course Moodle webpage on how to submit the assignment.

Evaluation Criteria for Assignment 4 (20 points)

Source Code	
Comments for all 3 questions (2 pts.)	
Description of the program (authors, date, purpose)	1 pts.
Description of variables and constants	0.5 pt.
Description of the algorithm	0.5 pts.

Programming Style for all 3 questions (2 pts.)	
Use of significant names for identifiers	1 pt.
Indentation and readability	1 pt.
Helper Classes (5 points)	
Proper constructors	1 pt.
Proper implementation of the toString() method	1 pt.
Proper access modifiers for the different methods	1 pt.
Proper implementation of helper methods	2 pt.
Game Class & Driver (11 points)	
Prompting user/reading player data in driver class	1 pt.
Correct implementation of white dice algorithm	2 pts.
Correct implementation of colour dice algorithm	2 pts.
Play algorithm	3 pts.
Proper error handling for user input	1 pt.
Computing scores correctly	1 pt.
Detecting and displaying winners	1 pt.
TOTAL	20 pts.