CS 101 - Algorithms & Programming I

The objective of this lab is to learn how to use for and do-while loop to implement automated repetition. Remember that analyzing your problems and designing them on a piece of paper *before* starting implementation/coding is always a best practice.

In this particular lab, **only use the <u>for</u> or <u>do-while</u> loops**, do *not* use the <u>while</u> loop.

0. Setup Workspace

Start VSC and open the previously created workspace named `labs_ws`. Now, under the `labs` folder, create a new folder named `lab5`.

In this lab, you are to have two Java classes/files (under `labs/lab5` folder) as described below. A third Java file containing the revision should go under this folder as well. We expect you to submit a total of 3 files including the revision, **without compressing** them. Do *not* upload other/previous lab solutions in your submission. The user inputs in the sample runs are shown in blue color.

1. Character Pyramid

Create a new/empty file of your own under the `lab5` folder named `Lab05_Q1.java` with a class with the same name. In this program, you are expected to build a pyramid with characters. To decide the height of the pyramid, you will get an input **integer** from the user. You are supposed to check the input and proceed if it is a positive number and less than 60. You should ask for input until a valid number is given. Your task is to print a pyramid using "**printable ASCII characters**" starting from "A." Each row starts with the character "A" and prints the following characters <u>in order</u> (see sample runs below).

Sample run 1:

```
Please enter a number: 8

       A
      A B
     A B C
    A B C D
   A B C D E
  A B C D E F
 A B C D E F G
A B C D E F G H
```

Sample run 2:

```
Please enter a number: 40

                                       A
                                      A B
                                     A B C
                                    A B C D
                                   A B C D E
                                  A B C D E F
                                 A B C D E F G
                                A B C D E F G H
                               A B C D E F G H I
                              A B C D E F G H I J
                             A B C D E F G H I J K
                            A B C D E F G H I J K L
                           A B C D E F G H I J K L M
                          A B C D E F G H I J K L M N
                         A B C D E F G H I J K L M N O
                        A B C D E F G H I J K L M N O P
                       A B C D E F G H I J K L M N O P Q
                      A B C D E F G H I J K L M N O P Q R
                     A B C D E F G H I J K L M N O P Q R S
                    A B C D E F G H I J K L M N O P Q R S T
                   A B C D E F G H I J K L M N O P Q R S T U
                  A B C D E F G H I J K L M N O P Q R S T U V
                 A B C D E F G H I J K L M N O P Q R S T U V W
                A B C D E F G H I J K L M N O P Q R S T U V W X
               A B C D E F G H I J K L M N O P Q R S T U V W X Y
              A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
             A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [
            A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \
           A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ]
          A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^
         A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _
        A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ `
       A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ ` a
      A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ ` a b
     A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ ` a b c
    A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ ` a b c d
   A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ ` a b c d e
  A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ ` a b c d e f
 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ ` a b c d e f g
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ ` a b c d e f g h
```

2. Pişti[1] (Card Game)

Create a new/empty file of your own under the `lab5` folder named `Lab05_Q2.java` with a class with the same name. Your program will be a simplified version of the popular card game "Pişti." Even if you are familiar with the game, you should still read the instructions, as *there are quite a bit of simplifications and changes from the original game.* A sample game run is added at the end of the explanations. Be careful about your outputs. They should be aligned with the given examples.

Remark: You are *not* allowed to use any data type or class we have not yet learned about (e.g., from the Collection framework such as `List`, `Array`, and `ArrayList`).

Our version of 'Pişti' is a 4-player card game: Player-1, Player-2, etc. We can see all the players' hands. The card game is played with a standard 52-card deck. Details of the card deck are given in Section 2.a. You can think of the computer as the dealer and also the game will be played by the computer. So you will not enter any input to select a card, the computer will select the card randomly from the hand.

The game aims to score the highest among players by collecting cards from the table. To do this, players must match one of the cards in their hand with the card at the top of the table.

Gameplay:
The gameplay starts when the deck is dealt. In the first round (opening hand), four cards are placed in the middle of the table (board), and four cards are given to each player. The game always begins with Player-1 and continues in order until all cards are played out. The players either collect (fish) cards from the board or add a card to the board if they cannot fish any cards. After the cards are exhausted in that game round, the dealer (computer) then deals each player four more cards from the remaining deck. The dealer, however, does not deal four cards onto the board as done for the opening round. The hands are played out until no remaining cards are to be dealt.

Collecting points:
Players aim to collect most number of cards from the board, which, in turn, increases their score. At the end of the game, the player with the highest score will win the game. To collect cards from the board, the player's hand should have the same rank as the top of the board. In this case, the player collects all the cards, and their score will increase by the total points of cards. In this scenario, each card has an equal score value of 1. If the player does not have a card that matches with the top of the board, that player should add a random card from their hands to the board, and the game continues with the next player.

The game can be summarized with the following steps, and each will be exemplified in the following sections:
 a. Deck creation & initial card drawn
   ● Create the deck and shuffle it
   ● Put the first four cards on the board for the opening round
   ● Start the game round
 b. Game Rounds
   ● Deal four cards to each player in order
   ● On the player's turn:
     ■ Check for the matching card: If the player's hand has the same rank as the top card, the player captures the whole pile on board and increases their score by the number of cards in the pile.
     ■ Otherwise, place a random card from their hand on the pile of board

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[1] "Bastra.", Wikipedia. Available at: https://en.wikipedia.org/wiki/Bastra.

a. Deck creation & initial card drawn

- First, construct a **string** that will be used in place of a card deck. A standard card deck comprises 13 ranks (numbers through 1 to 10, Jack, Queen, and King) in 4 suits (categories like clubs, diamonds, etc.), for a total of 52 cards. For simplicity, our deck includes positive digits (1-9) and T, J, Q, and K to represent 10, Jack, Queen, and King, respectively. So T is for 10, J is for Jack, Q is for Queen, and K is for King. We don't care about the card's suit, but there will be four of each rank. All in all, we have a 52-card deck where each digit/card is included four times. Use a **for** loop to create a string corresponding to a deck. Then, randomly shuffle it and print it.

```
Starting the game with the following deck:
1111222233334444555566667777888899999TTTTJJJJQQQQKKKK
Lets shuffle the deck:
4JQ33KJQ9239Q616K861K27T782T44QK69573T5J815T87J25941
```

Tip: To randomize, you can use the Java `Random` class.

- <u>Remember that the card at index 0 is at the top of the deck and the board</u>. Before game rounds start, print the first four cards on the table.

```
Put first 4 cards on table...
Cards on the table:4JQ3
```

- Start the game rounds. Deal four cards to all players in turn. We should see all the players' hands. Be aware that the cards are dealt from the shuffled deck in order.

```
Game round #1
       Player1: 3KJQ
       Player2: 9239
       Player3: Q616
       Player4: K861
```

b. Game Round

- After the hands are dealt, we can now start the core game loop. We always start with Player-1. Print Player-1's hand, the played card, and the remaining (current) hand after adding the card to the board. Also, print the cards on the table:

```
Player1 hand: 3KJQ  -> played: J -> current hand: 3KQ   --Cards on table: J4JQ3
```

- Now, it's Player-2's turn, etc. Be aware that, in this scenario, Player-4 has the same rank at the top of the board. Therefore, Player-4 collects all the cards from the board, and no cards are on the table anymore. After all the players played, print the points for that round.

```
Player2 hand: 9239  -> played: 9 -> current hand: 239   --Cards on table: 9J4JQ3
Player3 hand: Q616  -> played: 1 -> current hand: Q66   --Cards on table: 19J4JQ3
Player4 hand: K861  -> played: 1 -> current hand: K86   --Cards on table:
Points *** Player1: 0. Player2: 0. Player3: 0. Player4: 8 ***
```

- The game continues until players have no cards in hand. Notice that with 4 players and a 52-card deck, there will be a total of 3 rounds.

```
Player1 hand: 3KQ  -> played: 3 -> current hand: KQ    --Cards on table: 3
Player2 hand: 239  -> played: 3 -> current hand: 29    --Cards on table:
Player3 hand: Q66  -> played: 6 -> current hand: Q6    --Cards on table: 6
```

```
Player4 hand: K86  -> played: 6 -> current hand: K8    --Cards on table:
Points *** Player1: 0. Player2: 2. Player3: 0. Player4: 10 ***

Player1 hand: KQ  -> played: Q -> current hand: K       --Cards on table: Q
Player2 hand: 29  -> played: 9 -> current hand: 2       --Cards on table: 9Q
Player3 hand: Q6  -> played: Q -> current hand: 6       --Cards on table: Q9Q
Player4 hand: K8  -> played: 8 -> current hand: K       --Cards on table: 8Q9Q
Points *** Player1: 0. Player2: 2. Player3: 0. Player4: 10 ***

Player1 hand: K  -> played: K -> current hand:    --Cards on table: K8Q9Q
Player2 hand: 2  -> played: 2 -> current hand:    --Cards on table: 2K8Q9Q
Player3 hand: 6  -> played: 6 -> current hand:    --Cards on table: 62K8Q9Q
Player4 hand: K  -> played: K -> current hand:    --Cards on table: K62K8Q9Q
Points *** Player1: 0. Player2: 2. Player3: 0. Player4: 10 ***
```

- It's time for the next game round! The dealer (computer) again deals each player 4 more cards from the remaining deck.

```
Game round #2
      Player1: K27T
      Player2: 782T
      Player3: 44QK
      Player4: 6957
```

- The game continues as before…

```
Player1 hand: K27T  -> played: K -> current hand: 27T  --Cards on table:
Player2 hand: 782T  -> played: T -> current hand: 782  --Cards on table: T
Player3 hand: 44QK  -> played: 4 -> current hand: 4QK  --Cards on table: 4T
Player4 hand: 6957  -> played: 7 -> current hand: 695  --Cards on table: 74T
Points *** Player1: 9. Player2: 2. Player3: 0. Player4: 10 ***

Player1 hand: 27T  -> played: 7 -> current hand: 2T    --Cards on table:
Player2 hand: 782  -> played: 2 -> current hand: 78    --Cards on table: 2
Player3 hand: 4QK  -> played: K -> current hand: 4Q    --Cards on table: K2
Player4 hand: 695  -> played: 6 -> current hand: 95    --Cards on table: 6K2
Points *** Player1: 13. Player2: 2. Player3: 0. Player4: 10 ***

Player1 hand: 2T  -> played: 2 -> current hand: T       --Cards on table: 26K2
Player2 hand: 78  -> played: 7 -> current hand: 8       --Cards on table: 726K2
Player3 hand: 4Q  -> played: Q -> current hand: 4       --Cards on table: Q726K2
Player4 hand: 95  -> played: 5 -> current hand: 9       --Cards on table: 5Q726K2
Points *** Player1: 13. Player2: 2. Player3: 0. Player4: 10 ***

Player1 hand: T  -> played: T -> current hand:    --Cards on table: T5Q726K2
Player2 hand: 8  -> played: 8 -> current hand:    --Cards on table: 8T5Q726K2
Player3 hand: 4  -> played: 4 -> current hand:    --Cards on table: 48T5Q726K2
Player4 hand: 9  -> played: 9 -> current hand:    --Cards on table: 948T5Q726K2
Points *** Player1: 13. Player2: 2. Player3: 0. Player4: 10 ***
```

- It's time for game round #3!

```
Game round #3
      Player1: 3T5J
      Player2: 815T
      Player3: 87J2
      Player4: 5941
Player1 hand: 3T5J  -> played: T -> current hand: 35J  --Cards on table:
T948T5Q726K2
Player2 hand: 815T  -> played: T -> current hand: 815  --Cards on table:
Player3 hand: 87J2  -> played: J -> current hand: 872  --Cards on table: J
```

```
Player4 hand: 5941  -> played: 1 -> current hand: 594   --Cards on table: 1J
Points *** Player1: 13. Player2: 15. Player3: 0. Player4: 10 ***

Player1 hand: 35J  -> played: 3 -> current hand: 5J     --Cards on table: 31J
Player2 hand: 815  -> played: 8 -> current hand: 15     --Cards on table: 831J
Player3 hand: 872  -> played: 8 -> current hand: 72     --Cards on table:
Player4 hand: 594  -> played: 9 -> current hand: 54     --Cards on table: 9
Points *** Player1: 13. Player2: 15. Player3: 5. Player4: 10 ***

Player1 hand: 5J  -> played: 5 -> current hand: J       --Cards on table: 59
Player2 hand: 15  -> played: 5 -> current hand: 1       --Cards on table:
Player3 hand: 72  -> played: 2 -> current hand: 7       --Cards on table: 2
Player4 hand: 54  -> played: 5 -> current hand: 4       --Cards on table: 52
Points *** Player1: 13. Player2: 18. Player3: 5. Player4: 10 ***

Player1 hand: J  -> played: J -> current hand:    --Cards on table: J52
Player2 hand: 1  -> played: 1 -> current hand:    --Cards on table: 1J52
Player3 hand: 7  -> played: 7 -> current hand:    --Cards on table: 71J52
Player4 hand: 4  -> played: 4 -> current hand:    --Cards on table: 471J52
Points *** Player1: 13. Player2: 18. Player3: 5. Player4: 10 ***
```

- Since there are no remaining cards to be dealt, the game is over. The winner should be decided based on the highest point. In case multiple players have the same score, any one of them could be announced as the winner. **Hint**: The sum of the player's total points and the number of cards on the table should equal 52.

```
Total points:
Player1: 13
Player2: 18
Player3: 5
Player4: 10
Number of cards on table: 6

**** Player2 wins! ****
```

An additional sample run for the whole game:

```
Starting the game with the following deck:
11112222333344445555666677778888999TTTTJJJJQQQQKKKK
Lets shuffle the deck:
87917J8T58251656KJTQ29447J5T321Q2QT43QJ4K9K8679K3613

Put first 4 cards on table...
Cards on the table:8791

Game round #1
        Player1: 7J8T
        Player2: 5825
        Player3: 1656
        Player4: KJTQ
Player1 hand: 7J8T  -> played: 8 -> current hand: 7JT   --Cards on table:
Player2 hand: 5825  -> played: 8 -> current hand: 525   --Cards on table: 8
Player3 hand: 1656  -> played: 1 -> current hand: 656   --Cards on table: 18
Player4 hand: KJTQ  -> played: K -> current hand: JTQ   --Cards on table: K18
Points *** Player1: 5. Player2: 0. Player3: 0. Player4: 0 ***


Player1 hand: 7JT  -> played: J -> current hand: 7T     --Cards on table: JK18
Player2 hand: 525  -> played: 2 -> current hand: 55     --Cards on table: 2JK18
Player3 hand: 656  -> played: 6 -> current hand: 65     --Cards on table: 62JK18
Player4 hand: JTQ  -> played: Q -> current hand: JT     --Cards on table: Q62JK18
Points *** Player1: 5. Player2: 0. Player3: 0. Player4: 0 ***


Player1 hand: 7T  -> played: T -> current hand: 7       --Cards on table: TQ62JK18
Player2 hand: 55  -> played: 5 -> current hand: 5       --Cards on table: 5TQ62JK18
Player3 hand: 65  -> played: 5 -> current hand: 6       --Cards on table:
Player4 hand: JT  -> played: J -> current hand: T       --Cards on table: J
Points *** Player1: 5. Player2: 0. Player3: 10. Player4: 0 ***


Player1 hand: 7  -> played: 7 -> current hand:    --Cards on table: 7J
Player2 hand: 5  -> played: 5 -> current hand:    --Cards on table: 57J
Player3 hand: 6  -> played: 6 -> current hand:    --Cards on table: 657J
Player4 hand: T  -> played: T -> current hand:    --Cards on table: T657J
Points *** Player1: 5. Player2: 0. Player3: 10. Player4: 0 ***



Game round #2
        Player1: 2944
        Player2: 7J5T
        Player3: 321Q
        Player4: 2QT4
Player1 hand: 2944  -> played: 9 -> current hand: 244   --Cards on table: 9T657J
Player2 hand: 7J5T  -> played: 5 -> current hand: 7JT   --Cards on table: 59T657J
Player3 hand: 321Q  -> played: Q -> current hand: 321   --Cards on table: Q59T657J
Player4 hand: 2QT4  -> played: Q -> current hand: 2T4   --Cards on table:
Points *** Player1: 5. Player2: 0. Player3: 10. Player4: 9 ***


Player1 hand: 244  -> played: 4 -> current hand: 24     --Cards on table: 4
Player2 hand: 7JT  -> played: J -> current hand: 7T     --Cards on table: J4
Player3 hand: 321  -> played: 2 -> current hand: 31     --Cards on table: 2J4
Player4 hand: 2T4  -> played: 2 -> current hand: T4     --Cards on table:
Points *** Player1: 5. Player2: 0. Player3: 10. Player4: 13 ***


Player1 hand: 24  -> played: 2 -> current hand: 4       --Cards on table: 2
Player2 hand: 7T  -> played: T -> current hand: 7       --Cards on table: T2
Player3 hand: 31  -> played: 1 -> current hand: 3       --Cards on table: 1T2
Player4 hand: T4  -> played: 4 -> current hand: T       --Cards on table: 41T2
Points *** Player1: 5. Player2: 0. Player3: 10. Player4: 13 ***


Player1 hand: 4  -> played: 4 -> current hand:    --Cards on table:
```

```
Player2 hand: 7  -> played: 7 -> current hand:   --Cards on table: 7
Player3 hand: 3  -> played: 3 -> current hand:   --Cards on table: 37
Player4 hand: T  -> played: T -> current hand:   --Cards on table: T37
Points *** Player1: 10. Player2: 0. Player3: 10. Player4: 13 ***


Game round #3
      Player1: 3QJ4
      Player2: K9K8
      Player3: 679K
      Player4: 3613
Player1 hand: 3QJ4  -> played: 3 -> current hand: QJ4  --Cards on table: 3T37
Player2 hand: K9K8  -> played: K -> current hand: 9K8  --Cards on table: K3T37
Player3 hand: 679K  -> played: K -> current hand: 679  --Cards on table:
Player4 hand: 3613  -> played: 3 -> current hand: 361  --Cards on table: 3
Points *** Player1: 10. Player2: 0. Player3: 16. Player4: 13 ***

Player1 hand: QJ4  -> played: 4 -> current hand: QJ     --Cards on table: 43
Player2 hand: 9K8  -> played: K -> current hand: 98     --Cards on table: K43
Player3 hand: 679  -> played: 6 -> current hand: 79     --Cards on table: 6K43
Player4 hand: 361  -> played: 6 -> current hand: 31     --Cards on table:
Points *** Player1: 10. Player2: 0. Player3: 16. Player4: 18 ***

Player1 hand: QJ  -> played: J -> current hand: Q        --Cards on table: J
Player2 hand: 98  -> played: 8 -> current hand: 9        --Cards on table: 8J
Player3 hand: 79  -> played: 7 -> current hand: 9        --Cards on table: 78J
Player4 hand: 31  -> played: 1 -> current hand: 3        --Cards on table: 178J
Points *** Player1: 10. Player2: 0. Player3: 16. Player4: 18 ***

Player1 hand: Q  -> played: Q -> current hand:   --Cards on table: Q178J
Player2 hand: 9  -> played: 9 -> current hand:   --Cards on table: 9Q178J
Player3 hand: 9  -> played: 9 -> current hand:   --Cards on table:
Player4 hand: 3  -> played: 3 -> current hand:   --Cards on table: 3
Points *** Player1: 10. Player2: 0. Player3: 23. Player4: 18 ***

Total points:
Player1: 10
Player2: 0
Player3: 23
Player4: 18
Number of cards on table: 1

**** Player3 wins! ****
```