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ROBOTICS & ARTIFICIAL INTELLIGENCE DEPARTMENT

Total Marks: 04

Obtained Marks: _____

Programming for Artificial Intelligence

Assignment # 02

Last date of Submission: 21st March 2024

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ROBOTICS & ARTIFICIAL INTELLIGENCE DEPARTMENT

Instructions: *Copied or shown assignments will be marked zero. Late submissions are not entertained in any case.*

CLO 2 – PLO A, B – C3

Question 01.

(4 Marks)

Case Study Topic: Inheritance in Python

The following are the possible poker hands, in increasing order of value (and decreasing order of probability):

- pair: two cards with the same rank
- two pair: two pairs of cards with the same rank
- three of a kind: three cards with the same rank
- straight: five cards with ranks in sequence (aces can be high or low, so Ace-2-3-4-5 is straight and so is 10-Jack-Queen-King-Ace, but Queen-King-Ace-2-3 is not.)
- flush: five cards with the same suit
- full house: three cards with one rank, two cards with another
- four of a kind: four cards with the same rank
- straight flush: five cards in sequence (as defined above) and with the same suit

The goal of these exercises is to estimate the probability of drawing these various hands.

1. Download the following files:
 - [Card.py](#): A complete version of the `Card`, `Deck`, and `Hand` classes in this chapter.
 - [PokerHand.py](#): An incomplete implementation of a class that represents a poker hand, and some code that tests it.
2. If you run `PokerHand.py`, it deals seven 7-card poker hands and checks to see if any of them contains a flush. Read this code carefully before you go on.
3. Add methods to `PokerHand.py` named `has_pair`, `has_twopair`, *etc.* that return `True` or `False` according to whether or not the hand meets the relevant criteria. Your code should work correctly for “hands” that contain any number of cards (although 5 and 7 are the most common sizes).
4. Write a method named `classify` that figures out the highest-value classification for a hand and sets the `label` attribute accordingly. For example, a 7-card hand might contain a flush and a pair; it should be labeled “flush”.

Code [Card.py]:

```
"""

This module contains code from

Think Python: an Introduction to Software Design

Allen B. Downey

"""

import random

class Card(object):

    """represents a standard playing card."""

    suit_names = ["Clubs", "Diamonds", "Hearts", "Spades"]

    rank_names = [None, "Ace", "2", "3", "4", "5", "6", "7",

                  "8", "9", "10", "Jack", "Queen", "King"]

    def __init__(self, suit=0, rank=2):

        self.suit = suit

        self.rank = rank

    def __str__(self):

        return '%s of %s' % (Card.rank_names[self.rank],

                             Card.suit_names[self.suit])

    def __cmp__(self, other):

        t1 = self.suit, self.rank
```

```
t2 = other.suit, other.rank

return cmp(t1, t2)

def __lt__(self, other):

    if self.suit < other.suit:

        return True

    elif self.suit > other.suit:

        return False

    else:

        return self.rank < other.rank

class Deck(object):

    """represents a deck of cards"""

    def __init__(self):

        self.cards = []

        for suit in range(4):

            for rank in range(1, 14):

                card = Card(suit, rank)

                self.cards.append(card)

    def __str__(self):

        res = []

        for card in self.cards:

            res.append(str(card))
```

```
        return '\n'.join(res)

    def add_card(self, card):

        """add a card to the deck"""

        self.cards.append(card)

    def pop_card(self, i=-1):

        """remove and return a card from the deck.

        By default, pop the last card."""

        return self.cards.pop(i)

    def shuffle(self):

        """shuffle the cards in this deck"""

        random.shuffle(self.cards)

    def sort(self):

        """sort the cards in ascending order"""

        self.cards.sort()

    def move_cards(self, hand, num):

        """move the given number of cards from the deck into the Hand"""

        for i in range(num):

            hand.add_card(self.pop_card())

class Hand(Deck):

    """represents a hand of playing cards"""

    def __init__(self, label=''):

```

```
self.label = label

self.cards = []

def find_defining_class(obj, meth_name):

    """find and return the class object that will provide

    the definition of meth_name (as a string) if it is

    invoked on obj.

    """

    for ty in type(obj).mro():

        if meth_name in ty.__dict__:

            return ty

    return None

if __name__ == '__main__':

    deck = Deck()

    deck.shuffle()

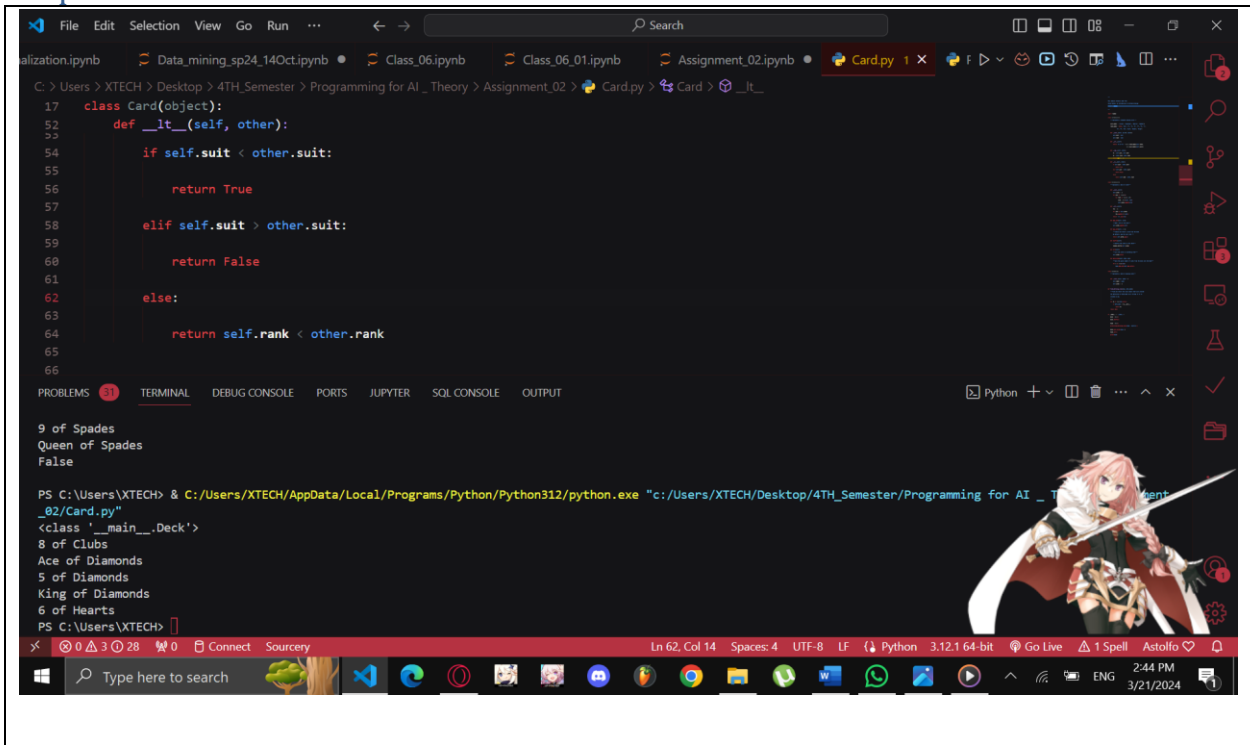
    hand = Hand()

    print(find_defining_class(hand, 'shuffle'))

    deck.move_cards(hand, 5)

    hand.sort()

    print(hand)
```



```

C:\Users\XTECH> Desktop > 4TH_Semester > Programming for AI_Theory > Assignment_02 > Card.py > Card > __lt__
17 class Card(object):
18     def __lt__(self, other):
19         if self.suit < other.suit:
20             return True
21         elif self.suit > other.suit:
22             return False
23         else:
24             return self.rank < other.rank
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```

```
self.suits = {}

for card in self.cards:

    self.suits[card.suit] = self.suits.get(card.suit, 0) + 1

def has_flush(self):

    """return True if the hand has a flush, False otherwise"""

    self.suit_hist()

    for val in self.suits.values():

        if val >= 5:

            return True

    return False

def has_pairs(self):
    self.rank = {}

    for card in self.cards:
        self.rank[card.rank] = self.ranks.get(card.rank, 0) + 1
    for val in self.ranks.values():
        if val == 2:
            return True
    return False

def has_two_pairs(self):
    pairs = 0
    self.ranks = {}
    for card in self.cards:
        self.ranks[card.rank] = self.ranks.get(card.rank, 0) + 1
    for val in self.ranks.values():
        if val == 2:
            pairs += 1
    return pairs == 2

def classify(self):
    if self.has_flush():
        self.label = "Flush"
    elif self.has_two_pairs():
        self.label = "Two Pairs"
    elif self.has_pairs():
        self.label = "Pairs"
    else:
```



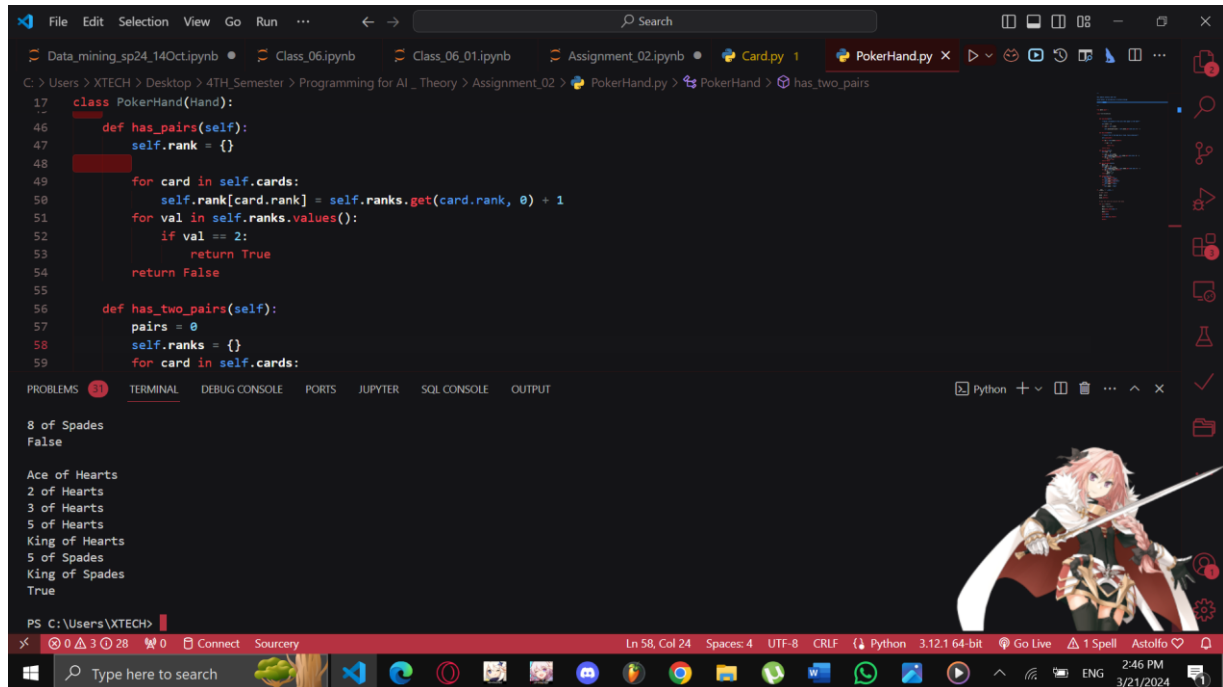
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        self.label = "None"

if __name__ == '__main__':

    deck = Deck()
    deck.shuffle()

    for i in range(7):
        hand = PokerHand()
        deck.move_cards(hand, 7)
        hand.sort()
        print(hand)
        print(hand.has_flush())
        print()
```

Output [True]:



```

class PokerHand(Hand):
    def has_pairs(self):
        self.rank = {}
        for card in self.cards:
            self.rank[card.rank] = self.ranks.get(card.rank, 0) + 1
        for val in self.ranks.values():
            if val == 2:
                return True
        return False

    def has_two_pairs(self):
        pairs = 0
        self.ranks = {}
        for card in self.cards:
            self.rank[card.rank] = self.ranks.get(card.rank, 0) + 1
        for val in self.ranks.values():
            if val == 2:
                pairs += 1
        return pairs == 2

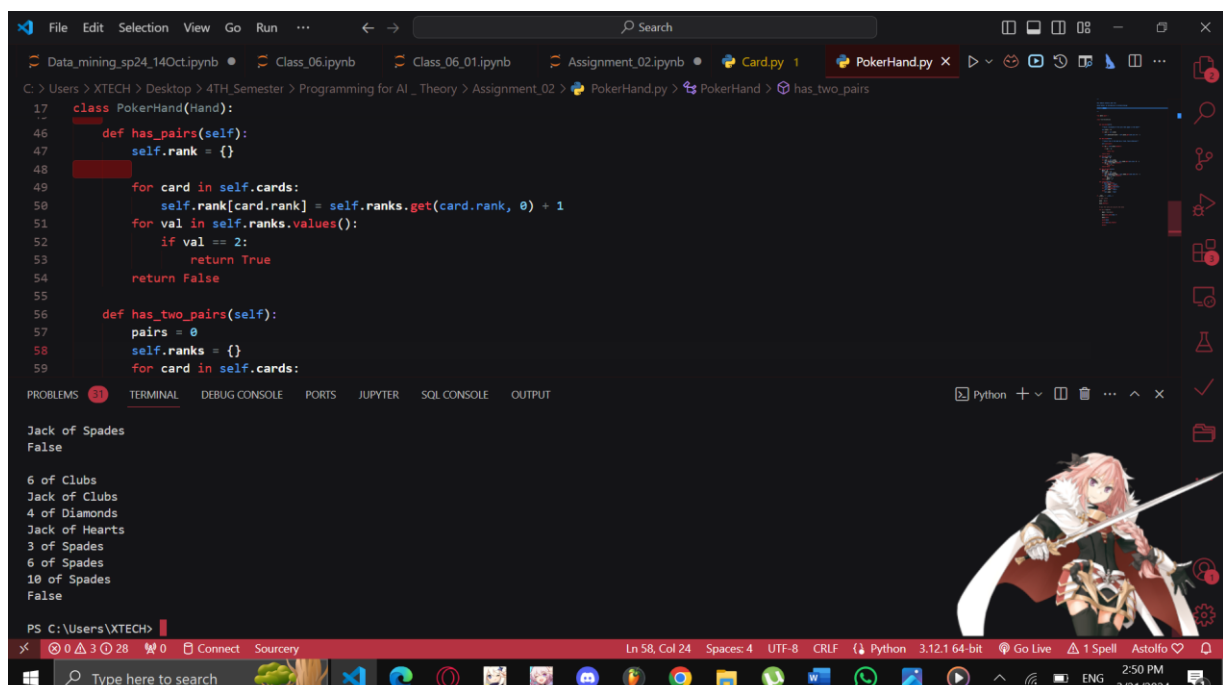
```

8 of Spades
False

Ace of Hearts
2 of Hearts
3 of Hearts
5 of Hearts
King of Hearts
5 of Spades
King of Spades
True

You can see that since there are fair pairs of “Hearts” in this shuffled pair it returns “True”. Since in Poker 5 cards of the same suit is called a flush. Even though there are two spades it is still considered a flush/

Output [False]:



```

class PokerHand(Hand):
    def has_pairs(self):
        self.rank = {}
        for card in self.cards:
            self.rank[card.rank] = self.ranks.get(card.rank, 0) + 1
        for val in self.ranks.values():
            if val == 2:
                return True
        return False

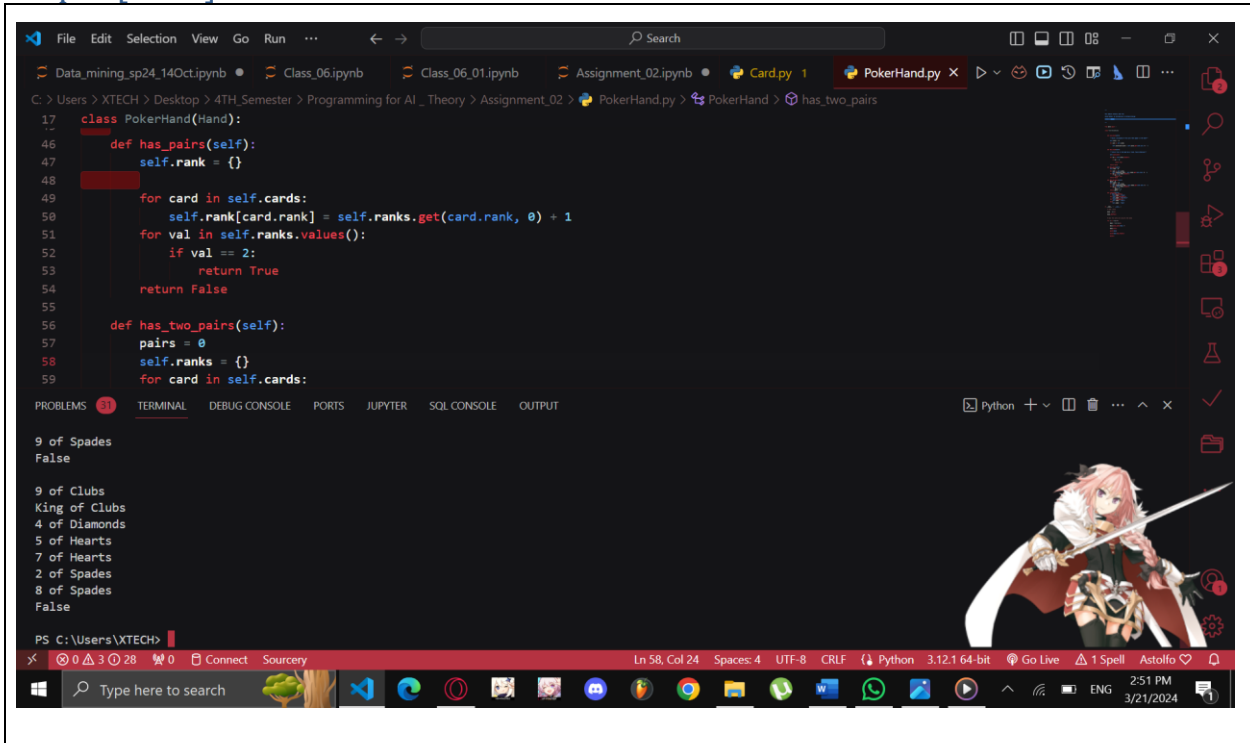
    def has_two_pairs(self):
        pairs = 0
        self.ranks = {}
        for card in self.cards:
            self.rank[card.rank] = self.ranks.get(card.rank, 0) + 1
        for val in self.ranks.values():
            if val == 2:
                pairs += 1
        return pairs == 2

```

Jack of Spades
False

6 of Clubs
Jack of Clubs
4 of Diamonds
Jack of Hearts
3 of Spades
6 of Spades
10 of Spades
False

Output [False]:



```
File Edit Selection View Go Run ... Search
Data_mining_sp24_14Oct.ipynb Class_06.ipynb Class_06_01.ipynb Assignment_02.ipynb Card.py 1 PokerHand.py x
C:\Users\XTECH\Desktop> 4TH_Semester > Programming for AI > Theory > Assignment_02 > PokerHand.py > PokerHand > has_two_pairs

17 class PokerHand(Hand):
18     def has_pairs(self):
19         self.rank = {}
20         for card in self.cards:
21             self.rank[card.rank] = self.rank.get(card.rank, 0) + 1
22         for val in self.rank.values():
23             if val == 2:
24                 return True
25         return False
26
27     def has_two_pairs(self):
28         pairs = 0
29         self.rank = {}
30         for card in self.cards:
31             self.rank[card.rank] = self.rank.get(card.rank, 0) + 1
32         for val in self.rank.values():
33             if val == 2:
34                 pairs += 1
35         return pairs == 2

PROBLEMS 51 TERMINAL DEBUG CONSOLE PORTS JUPYTER SQL CONSOLE OUTPUT
Python + - x

9 of Spades
False

9 of Clubs
King of Clubs
4 of Diamonds
5 of Hearts
7 of Hearts
2 of Spades
8 of Spades
False

PS C:\Users\XTECH>
```

Note: Paste the complete code here along with output screenshots.