Laboratory: Object Oriented Programming in Python

Problem 1: (60 minutes)

Define a class Card. A card has a suite (such as Heart, Club, Diamond, Spades) and a rank (such as Ace, King, Queen, Jack, 10, 9, 8, 7, 6, 5, 4, 3, 2). Your class has an init, a str, a repr, a eq (equality), and an lt (<) dunder. Inequality follows the rule that Ace is highest and 2 is lowest. If two cards have the same rank, then they are ordered as in bridge, i.e. spades > hearts > diamonds > clubs.

Then define a class Deck, whose only field is a sequence of the 52 different cards.

Write a function that selects a hand of five cards from the deck. A hand is a sorted list of five cards.

Write a function that given a hand, decides whether the hand is a pair, two pairs, triples, flush, straight, fours, or straight-flush.

Problem 2: (50 minutes)

A dual number is a pair of (floating point) numbers (a, b) thought of as a sum $a + b\epsilon$. Dual numbers are manipulated based on this expression and subject to the rule $\epsilon \times \epsilon = 0$. For example, to calculate the division of two dual numbers, we calculate

$$\frac{a + b\epsilon}{c + d\epsilon} = \frac{(a + b\epsilon) \cdot (c - d\epsilon)}{(c + d\epsilon)(c - d\epsilon)} = \frac{ac + (bc - ad)\epsilon}{c^2} = \left(\frac{a}{c}\right) + \left(\frac{b}{c} - \frac{ad}{c^2}\right)\epsilon,$$

if $c \neq 0$. If $c = 0$, your operation should raise a ZeroDivisionError. You do this by saying something like

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if c == 0:
    raise ZeroDivisionError
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Create a class for dual numbers with over-rides for all four elementary arithmetic operations. Dual numbers are applied in "Screw Theory".