Python for Math and Stat Fall 2022 Final Exam

This exam is worth 75 points. Assume that all necessary packages have been imported. When done with the exam, please **scan and upload to Gradescope**, then hand in the paper version.

1. (12 pts) Let

For the following 4 problems, write down what each code block would display if executed in a Jupyter cell.

- (a) arr[1, ::-1]
- **(b)** arr[:, 3] ** 2
- (c) arr[arr // 10 > 0]
- (d) (lambda x: x+10)(arr[1, 2:])

2.	tains di gi t and retui	B pts) Write a function digit_i n_num(digit, num) that returns True if the integer num conins digit and returns False otherwise. Assume that num is a positive int and that digit is an nt between 0 and 9 inclusive. Use arithmetic operations. DO NOT use string operations.				
	Examples:					
		56180) returns True.				
	digit in num(4.	5618073) returns Fal se.				
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3.	(8 pts) Write a function translate(words, lang_dict) that takes a string of words, separated by spaces, and returns a new string, replacing each word found in lang_dict with its equivalent. If a word is not found in the dictionary, it appears unchanged in the new string.						
	Example: To convert Spanish words into English, create a Spanish-English dictionary like the one below. Suppose the word 'pi ton' (which means python) is not included. $span_dict = \{ \ 'casa': \ 'house', \ 'azul': \ 'blue', \ \ldots \}$						
	Then translate('casa azul piton', span_dict) returns' house blue piton'.						

def func(n): return
Suppose func is an increasing function and you wish to find a value of n such that func(n) is greater than a threshold value. Write a function exceed(thresh) that checks the integers n=1, 2, 4, 8,, one at a time, and stops when func(n) is greater than thresh, returning the successful value of n. Each iteration doubles the previous value of n. (Assume that the domain and range of func include all positive real numbers.) Example:
Suppose func(n) returns n + $2**n$. Then exceed(25) returns 8 because 4 + 2^4 < 25 and 8 + 2^8 > 25.

4. (8 pts)

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Write a **recursive** function roots(nums) that takes a non-empty list of positive numbers a_i and returns the value of the corresponding nested square root expression.

Example: roots([7, 2, 4]) returns 3.	O because 7 +	$+ \overline{2 + \overline{4}} = 3.$	

7. (19 pts)

- (a) Create a class called Poi nt. Each object in the class represents a point in the *xy*-plane. It has two attributes:
 - x: the x-coordinate of the point
 - y: the y-coordinate of the point

and the following methods:

dist(pt)

(b) Add this Point method:

• connect(pt_l i st): given a list of Poi nts, draws line segments connecting the given point to the other points, in order.

Example:

```
pt1 = Point(-2, 6)
pt2 = Point(3, 3)
Point(1, 2).connect([pt1, pt2])
draws line segments from (1, 2) to (-2, 6) to (3, 3).
```

