Problem Set: Lesson 1

CDS 292. Fall, 2023

Instructions

In this document you will find a set of problems intended to be answered **by hand**, scanned and submitted to Blackboard. Make sure your document is well organized and contains readable responses to the questions. **Show your work! Full credit requires this. An answer without procedure is likely to elicit zero points.** There is one addendum to this handwritten rule: any required plot can be either scanned or sent as an additional file to your submission. If you choose to submit separate files with your plots, make sure they are labeled and can be easily identified.

Note: `Python` code questions will occur in problem sets. The answers have to be handwritten and must respect all `Python` syntax rules including proper indentation of code.

Total Points: 12

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1. Using the binomial coefficient definition, calculate
   (a) *[1 point]* $\binom{n}{n}$
   (b) *[1 point]* $\binom{10}{2}$
   (c) *[1 point]* $\binom{1}{2}$
2. *[1 point]* The binomial coefficients tell us the number of *different pairs of elements that can be formed*. For instance, $\binom{10}{2}$ counts the number of *pairs* of items -hence 2 in the bottom- that can be formed when we have 10 items to choose from. If a class has 22 students, how many different groups of size 2 could we be formed?
3. *[1 point]* For a given integer c, write down the formula that allows us to calculate the value for the binomial coefficient $\binom{c}{2}$. HINT: *you can look this formula up in the textbook.*
4. *[1 point]* Create a list with your first name and the first name of 5 people in the class (if you don't know the name of 5 of your classmates, use any 5 names). Store the list as `names`, and then create a list called `names_in_order` with the elements of `names` in alphabetical order. Print the result.
5. *[3 points]* Write `Python` code that takes the letters `a,b,c,d,e,f,` and prints all the possible pairs of them so that no pair is repeated, and also no pair is missing. Don't count permutations of the same two elements. Each pair should be printed to screen in a single line (so use the `print` statement). HINT: *You can print each pair in any format you think helps; for example,* `a`(space)`a`, `a`(tab)`a`, *or* `a,a`.
6. *[3 points]* Create a list `fib` with the Fibonacci sequence from the 20th to the 30th terms. Create a list `sqrtbet` with the square root of all integers between the 22nd and 23rd terms (including both). Create a variable `thesum` with the sum of all the elements in `sqrtbet`

Problem Set 1

(1a) $\binom{n}{n}$ $n!/n!(n-n)! = 1/(n-n)! = 1/0! = \boxed{1}$

(1b) $\binom{10}{2}$ $10!/2!(10-2)! = 1\times2\times3\ldots\times10/2\times1(8)! = 3{,}628{,}800/2(40{,}320)$

$3{,}628{,}800/80{,}640 = \boxed{45}$

(1c) $\binom{1}{2}$ $1!/2!(1-2)! = 1/2(-1)! = 1/-2 = \boxed{-1/2}$

↳ n not ≥ m

(2) $\binom{22}{2}$ $22!/2!(22-2)! = \boxed{22!/2(20)!}$

(3) $\binom{c}{2} = \boxed{c!/2!(c-2)!}$

(4) Python Code:

```
names = ['Chris', 'Frank', 'Eli', 'Beatrice', 'Amy', 'Dan']
names_in_order = ['Amy', 'Beatrice', 'Chris', 'Dan', 'Eli', 'Frank']
print(names_in_order)
```

(5) $\binom{6}{2}$ $6!/2!(6-2)! = 720/2(4)! = 720/48 = 15$ possible pairs

01 25
02 34
03 35
04 45
05
12
13
14
15
23
24

a, b, c, d, e, f ab, ac, ad, ae, af, bc, bd, be, bf, cd, ce, cf, de, df, ef

Python Code: 01, 02, 03, 04, 05, 12, 13, 14, 15, 23, 24, 25, 34, 35, 45

```
letters = ['a', 'b', 'c', 'd', 'e', 'f']
pairs = []
n = 0
n2 = 1
```

Problem Set 1

(5) Continued Code.....

```
    for e in letters:
Indent →    if n2<=5:
→           pairs.append(letters[n]+letters[n2])
            n2=n2+1

    n=1
    n2=2
    for e in letters:
→       if n2<=5:
→           pairs.append(letters[n]+letters[n2])
            n2=n2+1
    n=2
    n2=3
    for e in letters:
→       if n2<=5:
→           pairs.append(letters[n]+letters[n2])
            n2=n2+1
    n=3
    n2=4
    for e in letters:
→       if n2<=5:
→           pairs.append(letters[n]+letters[n2])
            n2=n2+1
    n=4
    n2=5
    for e in letters:
→       if n2<=5:
→           pairs.append(letters[n]+letters[n2])
            n2=n2+1
    print(pairs)
```

Problem Set 1

(6) Terms 20-30, Fibonacci Sequence

20: 6,765
21: 10,946
22: 17,711
23: 28,657
24: 46,368
25: 75,025
26: 121,393
27: 196,418
28: 317,811
29: 514,229
30: 832,040

fib

17,711
28,657
Sqrtbet.

√

Sum of all Square roots
thesum

Python Code:

```
fib=[6765,10946,17711,28657,46368,75025,121393,196418,317811,514229,832040]
Sqrtbet=[]
thesum=0

for e in fib:
    Sqrtbet.append(math.sqrt(e))

for e in Sqrtbet:
    thesum = thesum + e

print(thesum)
```