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Week 8, Examples 2

# 1.py

# Let's just use randrange and random

from random import *

def main():
    # generate 10 random numbers between 1 and 100
    # these numbers will be "uniformly distributed" between 1 and 100
    # (which means each number has the same probability of occurring)
    print("Uniformly random numbers in a given range \n")
    for i in range(10):
        number = randrange(1,101)
        print("{0:2}         {1:3}".format(i+1,number))

    # now generate 10 numbers that are uniformly distributed between 0 and 1.
    print("\n\nUniformly random numbers between 0 and 1 \n")
    for i in range(10):
        number = random()
        print("{0:2}         {1:0.6f}".format(i+1,number))

main()

# 2.py

# Want to toss a coin and find out how many tosses are required for it to land "H" (heads).

# Let the user input p, where p = probability that on a any toss the coin comes up H.

# The number of tosses until the coin comes up H is called a GEOMETRIC random variable.
Since the probability is $p$, it is called a geometric($p$) random variable.

```python
from random import *

def toss(p):
    if (random() <= p):
        return("H")
    else:
        return("T")

def main():
    p = eval(input("Probability of H on any toss for your coin? "))
    n = eval(input("How many coin-tossing experiments?" ))
    for i in range(n):
        seq =[]
        while(1):
            result = toss(p)
            seq.append(result)
            if (result == "H"):    break

        print(seq)
        print()

main()
```

Let $X$ = number of tossed to get $H$ on any given experiment.

Then $P(X = k ) = \text{probability that the number of tries to get } H \text{ is } k$ (i.e., that's the meaning)

$$
\begin{align*}
    k-1 \\
    = (1-p) . \quad p \quad \text{for } k = 1,2,3,4,5,........
\end{align*}
$$

This tells you the exact probability that $k$ tries are required
#3.py

# Just to remind you that we can pass a list to a function and change it

def emptyout(list):

    while(len(list)>0):
        list.pop()               # unless you specify an index, it removes the first item

def main():

    items=['1','5','22','91','7']

    print("Before function call\n")
    print(items)

    emptyout(items)

    print("\n\nAfter function call\n")
    print(items)

#4.py

# Let's put n distinct numbers in a list and "permute" the list k times.
# To "permute" is to make one arrangement. With n objects there are a total of n! arrangements.

# We won't try to list all the arrangements. You can do this for homework, by extending the
# idea shown here just a bit.

# In our example we don't check that a permuted list has not been repeated. For your homework
# problem you can do this check, but it would be taxing. It's better to find
# lists in order (as if you were counting)

from random import *

def permute(a):

    n = len(a)
output = []

while(len(output) < n):
    index = randrange(1,n-len(output)+1)
    output.append(a.pop(index-1))

return(output)

def main():

    n = eval(input("How many distinct numbers in your list? "))

    list = []

    print("Enter the ", n," numbers \n")  # hit return after each number entered

    for i in range(n):
        next = eval(input())
        list.append(next)

    print("\n",list,"\n")

    m = eval(input("How many permutations do you want? "))

    for j in range(m):
        # copy list into dup list

        dup = []
        for k in range(len(list)):  dup.append(list[k])

        print(permute(dup))

main()

#_________________________________________________________________
#5.py
#This shows the inner-workings of a linear congruential (uniform) random number generator.

from math import *
def uniform(seed):
    d2p31m = 2147483647
    d2p31 = 2147483711
    seed[0] = 16807*seed[0] - floor(16807*(seed[0])/d2p31m) * d2p31m
    return(fabs((seed[0]/d2p31)))

def main():
    seed=[1234567] #use any 7-10 digit number as the initial seed and then do not
    #touch the seed. Uniform() will do the rest.
    for i in range(100):
        print(i,uniform(seed))