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# TP N 4

#PARTIE A
# Exercice 1

for n in [30, 400]:
    facto = 1
    for k in range(1, n+1):
        facto *= k
    print("la factorielle de ", n, " est : ", facto)
""" On trouve 30! = 265 252 859 812 191 058 636 308 480 000
000
et 400! commence par 640 345 228
"""

#Exercice 2
facto = 6
somme = 0
for k in range (5,22,2):
    facto *= k*(k-1)
    somme += facto
print(somme)

""" On trouve 51 212 944 273 488 041 640 """

#Exercice 3
somme = 0
for k in range(100):
    somme += ((-1)**k)/(2*k+1)
print(somme)

""" On trouve 0.7828982258896384"""

# Exercice 4
import random as rd

n = rd.randint(1400,2501)

bissextile = n%400 == 0 or (n%100 !=0 and n%4 ==0)

print(n,bissextile)

# PARTIE B
# Exercice 1 et 2
import numpy as np
import matplotlib.pyplot as plt

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u = 1
L = [u]
for k in range(100):
    u= (u*(6-u**2))/4
    L.append(u)

print(L[1], L[20], L[100])

""" On trouve u_1 = 1.25
u_20 = 1.414213562373095
u_100 = 1.414213562373095
"""

plt.plot(L[0:20],'.:')
plt.show()

# Exercice 3

u = 0
L = [u]
for k in range(100):
    u= u + ((-1)**k)/(k+1)
    L.append(u)

print(L[1], L[20], L[100])

""" On trouve u_1 = 1.0
u_20 = 0.6687714031754279
u_100 = 0.688172179310195
"""

plt.plot(L[0:20],'.:')
plt.show()

# PARTIE C

u = 42
cpt = [0,0,0,0,0,0]
for n in range(10**7+1):
    if u%2 ==0:
        cpt[0] += 1
    if u ==2:
        cpt[1] += 1
    if u <= 1000:
        cpt[2] += 1
    if u%3 == 1:
        cpt[3] += 1
    if u%3 == 1 and u <= 1000:
        cpt[4] += 1
    if n%2 == 0 and u <= 1000 :
        cpt[5] += 1
    if n in [1, 100, 100000]:

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        print(n, u)
    u = (15091*u)%64007

""" On trouve
u_1 = 57759
u_100 = 50807
u_100000 = 62620
et les compteurs des questions :
a) 4 999 969
b) 156
c) 156 242
d) 3 333 434
e) 52 190
f) 84 682
"""

# PARTIE E (oui je sais : y'a pas de D)

a,b = 17, 30
s, L = 0, ([a,b,0],)
while b > 1:
    if b%2 == 0: b, a = b//2 , a * 2
    else : b, s = b - 1, s + a
    L += ([a,b,s],)
print (L + ([a,0, a+s],))

# PARTIE F

# Exercice 1
s = 0
for k in range(1,1001):
    if k%3 == 0 or k%5 == 0:
        s += k
print(s)

""" On trouve
234 168
"""

# Exercice 2
import numpy as np
a = 51806721 * np.log(63238182)
b= 52580236 * np.log(52443452)
print(a<b)
""" On trouve a<b"""

# Exercice 3
def triangulaire(n):
    return (n*(n+1)//2)

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def pentagonal(n):
    return (n*(3*n-1)//2)

def hexagonal(n):
    return (n*(2*n-1))

def maxtrig(x):
    n=1
    while (triangulaire(n)<x):
        n = n+1
    return([n, triangulaire(n)])

def est_trig(x):
    return(x == maxtrig(x)[1])

def maxpent(x):
    n=1
    while (pentagonal(n)<x):
        n = n+1
    return(n, pentagonal(n))

def est_pent(x):
    return(x == maxpent(x)[1])

def maxhexa(x):
    n=1
    while (hexagonal(n)<x):
        n = n+1
    return(n, hexagonal(n))

def est_hexa(x):
    return(x == maxhexa(x)[1])

def est_pentrap(x):
    p = int(np.sqrt(2*x/3))
    return(x== pentagonal(p) or x==pentagonal(p-1) or x
==pentagonal(p+1))

listepentahexa =[]

n = 1

while len(listepentahexa)<3:
    M = hexagonal(n)
    if est_pentrap(M):

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        listepentaehexa.append([M,n])
    n = n+1
print(listepentaehexa)
"""
On trouve 1533776805 qui vaut
H_27693 = P_31976 = T_55385
"""

#Exercice 4
"""
On constate que le nombre de rectangles possibles est
T_p * T_n avec p la hauteur, n la largeur et T_k le nombre
triangulaire d'ordre k
"""
candidat = 2*10**6
dim = (1,200)
for n in range(1,2001):
    M = triangulaire(n)
    x = 2*10**6/M
    p = maxtrig(x)[0]
    #print(n,x,p,M*triangulaire(p))
    if abs((2*10**6 - M*triangulaire(p)))<candidat:
        candidat = abs((2*10**6 - M*triangulaire(p)))
        dim = (n,p)
        print('cas 1',candidat,dim)
    if abs((2*10**6 - M*triangulaire(p+1)))<candidat:
        candidat = abs((2*10**6 - M*triangulaire(p+1)))
        dim = (n,p+1)
        print('cas 2',candidat,dim)
    if abs((2*10**6 - M*triangulaire(p-1)))<candidat:
        candidat = abs((2*10**6 - M*triangulaire(p-1)))
        dim = (n,p-1)
        print('cas 3',candidat,dim)
print(candidat,dim)
""" Il faut une hauteur 36 et une largeur 77 et le nombre
de rectangles possibles est 1999998
"""

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