Corrigé feuille exercices révision

[1]:
```
import numpy as np
import matplotlib.pyplot as plt
```

Exercice 1 : Représentation binaire

Q1.

[2]:
```
bin(213)
```

[2]:
```
'0b11010101'
```

Conversion du binaire en décimal

[3]:
```
int('0b11101',2)
```

[3]:
```
29
```

Conversion de l'hexadécimal vers le décimal

[4]:
```
int('0xCA',16)
```

[4]:
```
202
```

Q2.

0,375 est représenté par 0.011 car $0,375 = 0 + 0 \times 1/2 + 1 \times 1/4 + 1 \times 1/8$

Q3.

[5]:
```
def binaire(n):
    L = []
    while n>0:
        L.append(n%2)
        n = n//2
    return L
```

[6]:
```
binaire(213),bin(213)
```

[6]:
```
([1, 0, 1, 0, 1, 0, 1, 1], '0b11010101')
```

Q4.

[7]:
```
def octet(n):
    from math import log
    return int(log(n)/log(256))+1
```

[8]:
```
n = 21354654
p = octet(n)
p, n<256**p, 256**(p-1)<=n
```

[8]:
```
(4, True, True)
```

[9]:
```
def octet(n):
    p = 1
    while n>256:
        n = n//256
        p += 1
    return p
```

[10]:
```
n = 21354654
p = octet(n)
p, n<256**p, 256**(p-1)<=n
```

[10]:
```
(4, True, True)
```

Exercice 2 - Échantillonnage

Q1.

Une résolution de 16 bits donne $2^{16} = 65536$ valeurs ce qui donne une précision de $\frac{5}{2^{16}} = \frac{5}{65536}$.

[11]:
```
5/2**16
```

[11]:
```
7.62939453125e-05
```

Q2.

On a 1000 mesures par seconde $\times$ 16 bits $\times$ 5 secondes = 80 000 bits soit 10 000 octets.

Q3.

L'échantillonnage correspond à 16 000 bits par seconde ce qui est compatible avec 127 000 bits par seconde.

Q4.

[12]:
```
127000/16
```

[12]:
```
7937.5
```

La liaison permet 7937 échantillons par seconde soit une fréquence d'échantillonnage de 7937 Hz.

Exercice 3 - Calcul numérique

Q1.

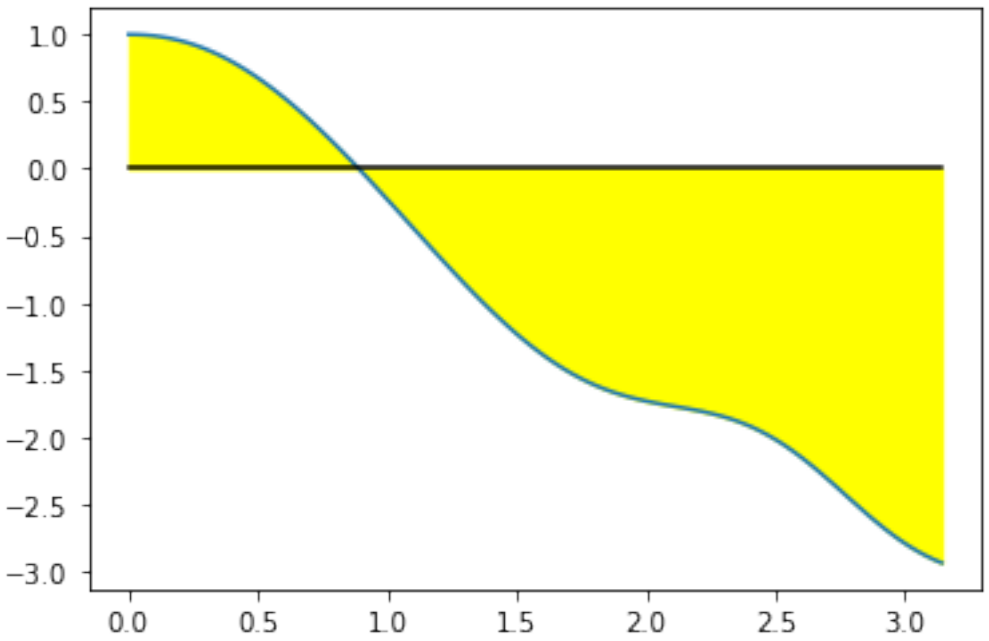
[13]:
```
def trapz(f,a,b,n):
    pas = (b-a)/n
    I = 0
    for i in range(n):
        I += pas *(f(a+i*pas) + f(a+(i+1)*pas))/2
    return I
```

[14]:
```
def f(t):
    return (np.cos(t**2)-t**3)/(1+t**2)
```

[15]:
```
trapz(f,0,np.pi,20)
```

[15]:
```
-3.0949580551501663
```

[16]:
```
Lt = np.linspace(0,np.pi,100)
Ly = f(Lt)
plt.plot(Lt,Ly)
plt.plot(Lt,0*Lt,"k")
plt.fill_between(Lt, 0*Lt, Ly, color = 'yellow')
pass
```



Q2.

[17]:
```
def dicho(f,a,b):
    while b-a>1e-5:
        m = (a+b)/2
        if f(m)*f(a)>0:
            a = m
        else:
            b = m
    return (a,b)
```

[18]:
```
dicho(f,0,3)
```

[18]:
```
(0.8892803192138672, 0.8892860412597656)
```

Q3.

[19]:
```
def newton(f,fp,x0):
    x1 = x0 + 1e-3
    while abs(x1-x0)>1e-7:
        x1 = x0
```

```
        x0 = x0 - f(x0)/fp(x0)
    return x1
```

[20]:
```
def fp(t):
    return -2*t*np.sin(t**2)/(1+t**2) - 3*t**2/(1+t**2) -2*t*f(t)/(1+t**2)
```

[21]:
```
newton(f,fp,1.0)
```

[21]:
```
0.8892810752556453
```

Exercice 4 : Recherche dichotomique

Invariant de boucle : à chaque itération de la bouche While, on a « `L[g] < val <= L[d]` » pour trouver la première occurence de val.

[22]:
```
def rechDicho(L,val):
    d = len(L)-1
    g = -1
    while d-g>1:
        m = (g+d)//2 # on veut obtenir un entier
        if L[m] < val :
            g = m # on garantit ainsi L[g]<val<= L[d]
        else:
            d = m
    if L[d] == val:
        return True,d
    else :
        return False,-1
```

[23]:
```
rechDicho([0,0,1,1,1,1,2,3,3,4,5,6,8,9],1)
```

[23]:
```
(True, 2)
```

[ ]:
```
```

Version récursive

[24]:
```
def rechDichoRec(val,L,g,d):
    if d-g<=1:
        if L[d] == val:
            return True, d
        else:
            return False, -1
    m = (g+d)//2 # on veut obtenir un entier
    if L[m] < val :
        g = m # on garantit ainsi L[g]<val<= L[d]
    else:
        d = m
    return rechDichoRec(val,L,g,d)
```

[25]:
```
L = [k for k in range(200)]
val = 35
rechDichoRec(val,L,0,len(L)),rechDichoRec(val+.5,L,0,len(L))
```

[25]:
```
((True, 35), (False, -1))
```

Exercice 5 - SQL

Q1. La moyenne des populations des communes de France :

```
SELECT AVG(pop) FROM communes
```

Q2. Les communes de Loire-Atlantique :

```
SELECT  * FROM communes AS C JOIN departements AS D ON C.dep_id = D.id  WHERE D.nom
="Loire-Atlantique"
```

Les communes des Pays de la Loire :

```
SELECT  * FROM communes AS C JOIN departements AS D ON C.dep_id = D.id JOIN regions
AS R ON D.reg_id = R.id  WHERE R.nom ="Pays de la Loire"
```

Q3. Pour la (ou les) commune (s) la (les) moins peuplée(s), on utilise une sous-requête :

```
SELECT nom FROM communes  WHERE pop = (SELECT  MIN(pop) FROM communes)
```

Q4. Pour les 100 communes les plus peuplées, on ordonne les communes par population décroissante et on ne conserve que les 100 premières.

```
SELECT nom,pop FROM communes  ORDER BY pop DESC LIMIT 100
```

Q5. Pour la moyenne de population des communes pour chaque département, on groupe les tuples par département pour calculer les moyennes :

```
SELECT  D.nom, AVG(C.pop) AS Moyenne FROM communes AS C JOIN departements AS D ON
C.dep_id = D.id  GROUP BY D.id
```

Q6. Pour les départements ayant une population totale supérieure à 1 million d'habitants, on ne conserve que les départements (groupes) ayant une population supérieure à 1 million :

```
SELECT  D.nom, SUM(C.pop) AS Total FROM communes AS C JOIN departements AS D ON
C.dep_id = D.id  GROUP BY D.id HAVING Total>1E6
```

Q7. Pour les départements ayant une population totale supérieure à la moyenne, on utilise deux sous-requêtes : une pour calculer les populations totales et une pour calculer la moyenne.

```
SELECT  D.nom, SUM(C.pop) AS Total FROM communes AS C JOIN departements AS D
ON C.dep_id = D.id  GROUP BY D.id HAVING Total>     (SELECT AVG(Total) FROM (
SELECT  D.nom, SUM(C.pop) AS Total          FROM communes AS C JOIN departements AS
D ON C.dep_id = D.id           GROUP BY D.id)      )
```

Exercice 6 : Algorithme de Gauss

[26]:
```
def recherchePivot(M,j):
    maxi = j                # on cherche le
    n = len(M)              # plus grand pivot en valeur absolue
    for i in range(j,n):
        if  abs(M[i,j])>abs(M[maxi,j]):
```

```
            maxi = i
    return maxi

def transvection(M,i,piv,alpha):
    p = len(M[0])
    for j in range(p):
        M[i,j] = M[i,j] + alpha*M[piv,j]

def echange(M,i,k):
    p = len(M[0])
    for j in range(p):
        M[i,j], M[k,j] = M[k,j], M[i,j]

def dilatation(M,i,alpha):
    p = len(M[0])
    for j in range(p):
        M[i,j] = alpha*M[i,j]


def echelonne(M):
    n = len(M)
    for j in range(n):              # M est de taille nx(n+1)
        piv = rechercheePivot(M,j)  # plus grand pivot dans la colonne j
        echange(M,j,piv)            # échange pivot et ligne courante
        for i in range(n):
            if i != j:              # transvections sur toutes les lignes
                transvection (M,i,j,-M[i,j]/M[j,j])
        dilatation(M,j,1/M[j,j])
    return M[:,-1]
```

[27]:
```
M = [[1.0,2,1,3,4 ],[2,1,1,-1,1],[1,2,1,1,0],[3,1,2,3,1]]
M = np.array(M)
M                 # M n'est pas un tableau d'entiers mais de flottants
```

[27]:
```
array([[ 1.,  2.,  1.,  3.,  4.],
       [ 2.,  1.,  1., -1.,  1.],
       [ 1.,  2.,  1.,  1.,  0.],
       [ 3.,  1.,  2.,  3.,  1.]])
```

[28]:
```
echelonne(M)
```

[28]:
```
array([  8.,   3., -16.,   2.])
```

[29]:
```
M
```

[29]:
```
array([[  1.,   0.,   0.,   0.,   8.],
       [  0.,   1.,   0.,   0.,   3.],
       [ -0.,  -0.,   1.,   0., -16.],
       [  0.,   0.,   0.,   1.,   2.]])
```

[30]:
```
def transvection(M,i,piv,alpha):
    M[i] = M[i] + alpha*M[piv]  #  M[i] == ligne i et M[ :, j]  == colonne j

def echange(M,i,k):
    # M[i], M[k] = M[k], M[i] # NE MARCHE PAS
    M[[i,k]] = M[[k,i]]  # MARCHE !!! Notation spécifique de numpy appelée
 ↪«advanced slicing».

def dilatation(M,i,alpha):
    M[i] = alpha*M[i]
```

[31]:
```
M = [[1.0,2,1,3,4 ],[2,1,1,-1,1],[1,2,1,1,0],[3,1,2,3,1]]
M = np.array(M)
M
```

[31]:
```
array([[ 1.,  2.,  1.,  3.,  4.],
       [ 2.,  1.,  1., -1.,  1.],
       [ 1.,  2.,  1.,  1.,  0.],
       [ 3.,  1.,  2.,  3.,  1.]])
```

[32]:
```
echelonne(M)
```

[32]:
```
array([  8.,   3., -16.,   2.])
```

[ ]:
```

```

Exercice 7 : Tri Fusion

[33]:
```
def fusion(L1,L2):
    """ on fusionne L1 et L2 en respectant l'ordre """
    nL = []
    i1, i2 = 0,0
    for k in range(len(L1)+len(L2)):
        if i2>= len(L2) or ( i1<len(L1) and L1[i1] < L2[i2] ):
            nL.append(L1[i1])
            i1 += 1
        else:
            nL.append(L2[i2])
            i2 += 1
    return nL
```

[34]:
```
def tri_fusion(L):

    if len(L) <=1: # cas de base si la liste contient un seul élément
        return L
    # sinon on trie récursivement les deux moitiés et on les fusionne
    L1 = tri_fusion(L[0:len(L)//2])
    L2 = tri_fusion(L[len(L)//2:])
    return fusion(L1,L2)
```

[35]:
```
L=[1,5,4,65,4,2,6,4,2,3,4,5,65,654,47,532,1,351,35,4]
tri_fusion(L), len(L) == len(tri_fusion(L))
```

[35]:
```
([1, 1, 2, 2, 3, 4, 4, 4, 4, 4, 5, 5, 6, 35, 47, 65, 65, 351, 532, 654], True)
```

[ ]:
```

```

Exercice 8 : Manipulation d'échantillons

[36]:
```
Lt = np.linspace(0,10,180)
Ly = f(Lt)
```

Q1.

[37]:
```
def valeurMoyenne(Lt,Ly):
    n = len(Lt) # nombre de points
    val = 0
    for i in range(n-1): # pour chaque intervalle
        val += (Lt[i+1] - Lt[i]) * (Ly[i] + Ly[i+1])/2
    return val/(Lt[-1]-Lt[0])
```

[38]:
```
valeurMoyenne(Lt,Ly)
```

[38]:
```
-4.704012893040506
```

Q2.

[39]:
```
def ecrire(nom_fichier,Lt, Ly):
    f = open(nom_fichier,"wt")
    for i in range(len(Lt)):
        f.write(str(Lt[i])+" ; "+str(Ly[i]) + "\n")
    f.close()
```

[40]:
```
ecrire("listes.txt",Lt,Ly )
```

Q3.

[41]:
```
def lire(nom_fichier):
    f = open(nom_fichier,"rt")
    Lt, Ly = [], []
    for ligne in f:
        L=ligne.split(";")
        Lt.append(float(L[0]))
        Ly.append(float(L[1]))
    return Lt, Ly
```

[42]:
```
Lt1,Ly1 = lire("listes.txt")
```

Q4. Moyenne glissante

[43]:
```
def moyenne(p,Lt,Ly):
    n = len(Ly)
```

```
    Lu=[]
    Lz=[]
    somme = 0
    for i in range(p-1):
        somme += Ly[i]
    for i in range(p,n):
        somme = somme + Ly[i]
        Lz.append(somme)
        somme -= Ly[i-p]
        Lu.append(Lt[i])
    return Lu,Lz
```

[44]:
```
Lu,Lz = moyenne(4,Lt,Ly)
```

[45]:
```
len(Lu), len(Lt)
```

[45]: (176, 180)

Exercice 9 : Fonction récursive

[46]:
```
def permut(n):
    if n == 1:                    # cas de base
        return [[1]]
    else:
        L = permut(n-1)           # on calcule les permutations des premiers
        nL = []
        for p in L:               # pour chaque permutation des n-1 premiers
            for k in range(n-1): # on place n en position k
                nL.append( p[:k] + [n] + p[k:])
            nL.append(p + [n])    # et on place n en dernière position
        print(nL)
        return nL
```

[47]:
```
len(permut(4))
```

```
[[2, 1], [1, 2]]
[[3, 2, 1], [2, 3, 1], [2, 1, 3], [3, 1, 2], [1, 3, 2], [1, 2, 3]]
[[4, 3, 2, 1], [3, 4, 2, 1], [3, 2, 4, 1], [3, 2, 1, 4], [4, 2, 3, 1], [2, 4, 3,
1], [2, 3, 4, 1], [2, 3, 1, 4], [4, 2, 1, 3], [2, 4, 1, 3], [2, 1, 4, 3], [2, 1,
3, 4], [4, 3, 1, 2], [3, 4, 1, 2], [3, 1, 4, 2], [3, 1, 2, 4], [4, 1, 3, 2], [1,
4, 3, 2], [1, 3, 4, 2], [1, 3, 2, 4], [4, 1, 2, 3], [1, 4, 2, 3], [1, 2, 4, 3],
[1, 2, 3, 4]]
```

[47]: 24

[48]:
```
L = [0,1,2]
L[:0]
```

[48]: []

[ ]:

Exercice 10 : Manipulation de listes

Q1.

[49]:
```
def zip(L1,L2):
    assert len(L1)==len(L2)
    L = []
    for k in range(len(L1)):
        L.append( [L1[k], L2[k]] )
    return L
```

[50]:
```
L1 = [1,2,3,4,5,6]
L2 = ["a","b","c","d","e","f"]
zip(L1,L2)
```

[50]:
```
[[1, 'a'], [2, 'b'], [3, 'c'], [4, 'd'], [5, 'e'], [6, 'f']]
```

Q2.

[51]:
```
def seuil1(L,s):
    i = 0
    while L[i]<s:
        i += 1
    return i
```

[52]:
```
seuil1(L1,3)
```

[52]:
```
2
```

Q3.

[53]:
```
def seuil2(L,s):
    i = len(L)-1
    while L[i]<s:
        i -= 1
    return i
```

Q4.

[54]:
```
def seuilx(LP,s):
    L = []
    for k in range(len(LP)):
        if LP[k][0]>= s:
            L.append(LP[k])
    return L
```

[55]:
```
LP = [ [1,2], [3,4], [1,3], [2,5]]
seuilx(LP,2)
```

[55]:
```
[[3, 4], [2, 5]]
```

Q5.

[56]:
```
def passage(L,s):
    res = []
    for k in range(len(L)-1):
        if L[k]< s <= L[k+1]:
            res.append(k)
    return res
```

[57]:
```
L3 = [1,2,3,4,3,2,1,2,3,4,5,6,5,4,3,2,1]
passage(L3,3)
```

[57]:
```
[1, 7]
```

Q6.

[58]:
```
def monotonie(L):
    croissant = L[0]< L[1]
    res = []
    i = 0
    while i< len(L) -1:
        if croissant and L[i]>L[i+1]: # ça devient décroissant
            croissant = False
            res.append(i)
        if not croissant and L[i]<L[i+1]: # ça devient croissant
            croissant = True
            res.append(i)
        i += 1
    return res
```

[59]:
```
monotonie(L3)
```

[59]:
```
[3, 6, 11]
```

[ ]:

[ ]: