01_SayisalHesabinNitelikleri

March 27, 2020

1 SAYISAL HESABIN NİTELİKLERİ

1.1 BİLGİSAYARDA SAYI TEMSİLLERİ

En küçük hafıza birimi **bit** (**bi**nary digi**t**) adlandırılır.

1 bytes, (bayt) diye okuyoruz, 8 bit içerir.

1 bytes = 8 bit

8 bit'te $2^8 = 256 = 0, 1, \ldots, 254, 255$ bilgi saklanabilir.

<img width="45%", src="./sekiller/units_policy_ubuntu.PNG">

1.1.1 TAM SAYILAR

Saklanabilecek tam sayı büyüklüğünü ayrılan bit sayısı (veya byte) belirler.

16 bit = 2 bytes'lık olanlar

[1]:
```
# Bütün hepsi pozitifken
enBuyuk_16bit_Pozitif_TamSayi = 2**16
print enBuyuk_16bit_Pozitif_TamSayi
```

```
65536
```

[2]:
```
# Yarısı negatif / Yarısı Pozitif
enKucuk_16bit_Negatif_TamSayi = -2**16/2
enBuyuk_16bit_Pozitif_TamSayi = 2**16/2 - 1
print enKucuk_16bit_Negatif_TamSayi
print 0
print enBuyuk_16bit_Pozitif_TamSayi
```

```
-32768
0
32767
```

[3]:
```
# 10'luktan 2'lik tabana çevirim
tamSayi10 = raw_input("10'luk tabandaki tam sayı = ?")
```

```
tamSayi10 = int(tamSayi10)

bolum = abs(tamSayi10)
if bolum!=0:
    while bolum>0:
        print bolum, bolum%2
        bolum = int(bolum/2.)
else:
    print 0
```

```
MTAnbHVrIHRhYmFuZGFraSBOYW0gc2F5xLEgPSA/
 1212 0
6 0
3 1
1 1
```

[4]:
```
# 10'luktan herhangi bir tabana çevirim
taban = 2
bolum = tamSayi10
while bolum>0:
    print bolum, bolum%taban
    bolum = int(bolum/taban)
```

```
12 0
6 0
3 1
1 1
```

[5]:
```
# çıktısı düzenlenmiş
taban = 2
bolum = tamSayi10
tamSayi2 = ""
while bolum>0:
    kalan = bolum % taban
    tamSayi2 = str(kalan) + tamSayi2
    #tamSayi2 = tamSayi2 + str(kalan)
    bolum = int(bolum/taban)

print "(%s)_10 = (%s)_%s"%(tamSayi10, tamSayi2, taban)
```

```
(12)_10 = (1100)_2
```

[6]:
```
#çıktısı 16 bit'e göre düzenlenmiş tam sayı
def sgn(x):
    if x>=0:
        s="0"
    else:
```

```
        s="1"
    return s

#tamSayi10 = 2**15-1
tamSayi10 = -2**15+1
tamSayi10 = -13
taban = 2
isaret = sgn(tamSayi10)

bolum = abs(tamSayi10)
tamSayi2 = ""
while bolum>0:
    kalan = bolum % taban
    tamSayi2 = str(kalan) + tamSayi2
    bolum = int(bolum/taban)

print "".join([str(i%10) for i in range(1, 17)])
print isaret + "0"*(15-len(tamSayi2)) + tamSayi2
print "(%s)_10 = (%s%s)_2 "%(tamSayi10 , isaret , "0"*(15-len(tamSayi2)) +␣
 ↪tamSayi2)
```

```
1234567890123456
1000000000001101
(-13)_10 = (1000000000001101)_2
```

[7]:
```
a = 2**1000
print a
```

```
10715086071862673209484250490600018105614048117055336074437503883703510511249361
22493198378815695858127594672917553146825187145285692314043598457757469857480393
45677748242309854210746050623711418779541821530464749835819412673987675591655439
46077062914571196477686542167660429831652624386837205668069376
```

2 REEL SAYILAR

https://www.h-schmidt.net/FloatConverter/IEEE754.html

2.1 $y = (1 + M) * 2^x$

[8]:
```
from math import log
y = 0.1

us = int(log(y, 2))-1
mantis = y/2**us
```

```
print "2^%s"%us
print mantis
```

```
2^-4
1.6
```

2.2 32 bitlik sistemde mantis kısmının hesaplanışı

2.2.1 $(0.5)_{10} = (0.10000000000000000000000)_2$

2.2.2 $(0.25)_{10} = (0.01000000000000000000000)_2$

Bu tür ondalık sayılar için aşağıdaki şartı incelemek gerekiyor.
İncelendiğinde basamak değişkeninin 1 azaltılmadığı görülür.

```
if basamak>log(gecici,2):
    basamak -= 1
```

[9]:
```
from math import log

ondalik10 = .125
ondalik2List = ["0"]*23

gecici = ondalik10
basamak = 0
while abs(basamak)<23 and gecici>0:
    basamak = int(log(gecici,2))
    print basamak, log(gecici,2), gecici
    if basamak>log(gecici,2):
        basamak -= 1
    if abs(basamak)>23: break
    print basamak, log(gecici,2), gecici
    ondalik2List[abs(basamak)-1] = "1"
    gecici= gecici - 2**basamak

ondalik2 = ''.join(ondalik2List)
print ondalik2
```

```
-3 -3.0 0.125
-3 -3.0 0.125
00100000000000000000000
```

2.2.3 $(0.6)\_10 = (0.10011001100110011001100)\_2$

2.2.4 $(0.7)\_10 = (0.10110011001100110011001)\_2$

Bu tür ondalık sayılar için aşağıdaki şartı incelemek gerekiyor.
İncelendiğinde basamak değişkeninin 1 azaltıldığı görülür.

```
if basamak>log(gecici,2):
    basamak -= 1
```

[10]:
```
ondalik2List = ["0"]*23
ondalik2List[abs(-23)-1] = '1'
''.join(ondalik2List)
```

[10]:
```
'00000000000000000000001'
```

[11]:
```
from math import log

ondalik10 = .6
ondalik2List = ["0"]*23

gecici = ondalik10
basamak = 0
while abs(basamak)<23 and gecici>0:
    basamak = int(log(gecici,2))
    #print basamak, log(gecici,2), gecici
    if basamak>log(gecici,2):
        basamak -= 1
    if abs(basamak)>23: break
    print basamak, log(gecici,2), gecici
    ondalik2List[abs(basamak)-1] = "1"
    gecici = gecici - 2**basamak

ondalik2 = ''.join(ondalik2List)
print ondalik2
```

```
-1 -0.736965594166 0.6
-4 -3.32192809489 0.1
-5 -4.73696559417 0.0375
-8 -7.32192809489 0.00625
-9 -8.73696559417 0.00234375
-12 -11.3219280949 0.000390625
-13 -12.7369655942 0.000146484375
-16 -15.3219280949 2.44140625e-05
-17 -16.7369655942 9.15527343748e-06
-20 -19.3219280949 1.52587890623e-06
-21 -20.7369655942 5.72204589822e-07
10011001100110011001100
```

[12]:
```
#12345678901234567890123
10011001100110011001100
10011001100110011001100
```

[12]:
```
10011001100110011001100L
```

2.3 64 bitlik sistemde mantis kısmının hesaplanışı

[13]:
```
from math import log

ondalikBit = 52
ondalik10 = .6
ondalik2List = ["0"]*ondalikBit

gecici = ondalik10
basamak = 0
while abs(basamak)<ondalikBit and gecici>0:
    basamak = int(log(gecici,2))
    if basamak>log(gecici,2):
        basamak -= 1
    if abs(basamak)>ondalikBit: break
    print basamak, gecici
    ondalik2List[abs(basamak)-1] = "1"
    gecici= gecici - 2**basamak

ondalik2 = ''.join(ondalik2List)
print ondalik2
```

```
-1 0.6
-4 0.1
-5 0.0375
-8 0.00625
-9 0.00234375
-12 0.000390625
-13 0.000146484375
-16 2.44140625e-05
-17 9.15527343748e-06
-20 1.52587890623e-06
-21 5.72204589822e-07
-24 9.53674316184e-08
-25 3.5762786843e-08
-28 5.96046445533e-09
-29 2.23517415687e-09
-32 3.72529007642e-10
-33 1.39698363988e-10
-36 2.32830421609e-11
```

```
-37 8.73112693256e-12
-40 1.45516931838e-12
-41 5.45674616603e-13
-44 9.09272657168e-14
-45 3.4083846856e-14
-48 5.66213742559e-15
-49 2.10942374679e-15
-52 3.33066907388e-16
10011001100110011001100110011001100110011001100110011001
```

2.4 32, 64 veya 128 bitlik sistemde reel sayılar

128 bit malesef çalışmıyor!?

[14]:
```
from math import log
x = int(log(0.1, 2))
print 0.1/2**(x-1)
print x-1
```

```
1.6
-4
```

[15]:
```
from math import log

# verilen bir sayının işaretinin
# 2'lik (binary) temsili
def sgn(x):
    if x>=0:
        s="0" # +1
    else:
        s="1" # -1
    return s

isaretliSayi = -1.234
kacBit = 128

isaret = sgn(isaretliSayi)
sayi10 = abs(isaretliSayi)

# 32, 64, 128 bit dağılımları
# https://en.wikipedia.org/wiki/Quadruple-precision_floating-point_format
bitH = {32:[1, 8, 23], 64:[1, 11, 52], 128:[1, 15, 112]}
usBit = bitH[kacBit][1]
ondalikBit = bitH[kacBit][2]

# verilen bir reel sayıyı 1.M x 2^us şekline çevir
us = int(log(sayi10, 2))
```

```
if 2**us>sayi10:
    us = us - 1
# mantis = 1.M - 1
mantis = sayi10/2**us - 1

# 2^us kısmının 32 veya 64 bit temsili
us2lik = us + 2**(usBit-1)-1
bolum = us2lik
tamSayi2 = ""
while bolum>0:
    kalan = bolum % 2
    tamSayi2 = str(kalan) + tamSayi2
    bolum = int(bolum/2.)

# verilen sayının ondalık kısmının 2'lik
# temsilinin kaydedileceği liste
ondalik2List = ["0"]*ondalikBit

# ondalık kısım 2'lik sisteme çeviriliyor
gecici = mantis
basamak = 0
while abs(basamak)<ondalikBit and gecici>0:
    basamak = int(log(gecici,2))
    if basamak>log(gecici,2):
        basamak -= 1
    if abs(basamak)>ondalikBit: break
    #print basamak, gecici
    ondalik2List[abs(basamak)-1] = "1"
    gecici= gecici - 2**basamak

ondalik2 = ''.join(ondalik2List)

print "".join([str(i%10) for i in range(1, kacBit+1)])
print isaret + "0"*(usBit-len(tamSayi2)) + tamSayi2 + ondalik2
print "işaret: isaret = %+i = (%s)_2"%(-2*int(isaret)+1, isaret)
print "2^us  : us = %s = %s = (%s)_2"%(us,us2lik,tamSayi2)
print "mantis: mantis = %s = (%s)_2"%(mantis, ondalik2)
```

```
12345678901234567890123456789012345678901234567890123456789012345678901234567890
12345678901234567890123456789012345678901234567890123456789012345678
10111111111111110011101111100111011011001000101101000011100101011000000000000000
00000000000000000000000000000000000000000000000000
işaret: isaret = -1 = (1)_2
2^us  : us = 0 = 16383 = (11111111111111)_2
mantis: mantis = 0.234 = (00111011111001110111011001000101101000011100101011000000
00000000000000000000000000000000000000000000000000000000000000)_2
```

2.4.1 2'likten tekrar 10'luk sisteme çevirim

[16]:
```
# 2'lik sistemden tekrar ondalik sisteme çevirim
isaret10 = (-2*int(isaret)+1)
ondalik2den10a = 0
for i,b in enumerate(ondalik2):
    ondalik2den10a += int(b)*2**-(i+1)

sayi2den10a = isaret10*(1+ondalik2den10a)*2**us

print "orjinal sayı =", isaretliSayi
print "çevirilen sayı =", sayi2den10a
print "hata miktarı =", (isaretliSayi-sayi2den10a)
```

```
orjinal sayı = -1.234
çevirilen sayı = -1.234
hata miktarı = 0.0
```

3 SAYISAL HATA TÜRLERİ

1. **Yuvarlama Hatası (Round-off error)**

- http://mathworld.wolfram.com/RoundoffError.html
- Roundoff error occurs because of the computing device's inability to deal with certain numbers. Such numbers need to be rounded off to some near approximation which is dependent
on the word size used to represent numbers of the device.

2. **Kesme Hatası (Truncation Error)**

- https://tr.0wikipedia.org/wiki/Kesme_hatası
- Truncation error refers to the error in a method, which occurs because some series (finite or infinite) is truncated to a fewer number of terms. Such errors are essentially algorithmic errors and we can predict the extent of the error that will occur in the method.

3.1 YUVARLAMA HATASI

3.1.1 Her zaman A - A = 0 olmayabilir.

FORTRAN

[17]:
```
%%sh
# fortran programını oluştur
cat > fortran_Programi.for << EOF
C FORTRAN PROGRAMI BAŞI
C       REAL*4 A
```

```
C       REAL*8 B, Z
       A = COS(1.1)
       B = SIN(1.1)
       Z = A - (A/B)*B
       PRINT *, A
       PRINT *, (A/B)*B
       PRINT *, Z
       END
C FORTRAN PROGRAMI SONU
EOF

# fortran programı derle
#
# gfortran derleyicisi
# gfortran -o fortran_Programi fortran_Programi.for
#
# f77 derleyicisi
f77 -o fortran_Programi fortran_Programi.for

# fortran programını çalıştır
./fortran_Programi

# fortran programını sil
#rm -f fortran_Programi*
```

```
 0.453596085
 0.453596085
  0.00000000
```

PYTHON

[18]:
```
from math import *
A = cos(1.1)
B = sin(1.1)
Z = A - (A/B)*B
print A
print (A/B)*B
print Z
```

```
0.453596121426
0.453596121426
-5.55111512313e-17
```

[19]:
```
from math import *
A = cos(1.1)
B = sin(1.1)
Z = A - (A/B)*B
```

```
A
```

[19]: 0.4535961214255773

[20]:
```
from math import *
A = cos(1.1)
B = sin(1.1)
Z = A - (A/B)*B
(A/B)*B
```

[20]: 0.45359612142557737

[21]:
```
0.4535961214255773
0.45359612142557737
```

[21]: 0.45359612142557737

3.1.2 Küçük ve büyük sayıları yan yana getirmek risklidir.

FORTRAN

[22]:
```
%%sh
# fortran programını oluştur
cat > fortran_Programi.for << EOF
        REAL*16 TOPLAM
        TOPLAM = 1.0
        DO 10, I = 1, 10000
            TOPLAM = TOPLAM + 0.00001
10      CONTINUE
        PRINT *, 'TOPLAM = ', TOPLAM
        END
C FORTRAN PROGRAMI SONU
EOF

# fortran programı derle
# f77 derleyicisi
f77 -o fortran_Programi fortran_Programi.for

# fortran programını çalıştır
./fortran_Programi

# fortran programını sil
rm -f fortran_Programi*
```

```
 TOPLAM =     1.09999999747378751635551452636718750
```

PYTHON

[23]:
```
toplam = 1.0
for i in range(10000):
    toplam += 0.00001
print 'toplam = ', toplam
```

```
toplam =  1.1
```

[24]:
```
toplam = 1.0
for i in range(10000):
    toplam += 0.00001
toplam
```

[24]:
```
1.1000000000006551
```

[25]:
```
whos
```

```
Variable                       Type                       Data/Info
-------------------------------------------------------------------------
A                              float                      0.453596121426
B                              float                      0.891207360061
Z                              float                      -5.55111512313e-17
a                              long
1071508607186267320948425<…>16526243868372056680693 76
acos                           builtin_function_or_method <built-in function
acos>
acosh                          builtin_function_or_method <built-in function
acosh>
asin                           builtin_function_or_method <built-in function
asin>
asinh                          builtin_function_or_method <built-in function
asinh>
atan                           builtin_function_or_method <built-in function
atan>
atan2                          builtin_function_or_method <built-in function
atan2>
atanh                          builtin_function_or_method <built-in function
atanh>
b                              str                        0
basamak                        int                        -49
bitH                           dict                       n=3
bolum                          int                        0
ceil                           builtin_function_or_method <built-in function
ceil>
copysign                       builtin_function_or_method <built-in function
copysign>
cos                            builtin_function_or_method <built-in function
cos>
cosh                           builtin_function_or_method <built-in function
```

```
cosh>
degrees                         builtin_function_or_method    <built-in function
degrees>
e                               float                         2.71828182846
enBuyuk_16bit_Pozitif_TamSayi   int                           32767
enKucuk_16bit_Negatif_TamSayi   int                           -32768
erf                             builtin_function_or_method    <built-in function
erf>
erfc                            builtin_function_or_method    <built-in function
erfc>
exp                             builtin_function_or_method    <built-in function
exp>
expm1                           builtin_function_or_method    <built-in function
expm1>
fabs                            builtin_function_or_method    <built-in function
fabs>
factorial                       builtin_function_or_method    <built-in function
factorial>
floor                           builtin_function_or_method    <built-in function
floor>
fmod                            builtin_function_or_method    <built-in function
fmod>
frexp                           builtin_function_or_method    <built-in function
frexp>
fsum                            builtin_function_or_method    <built-in function
fsum>
gamma                           builtin_function_or_method    <built-in function
gamma>
gecici                          float                         0.0
hypot                           builtin_function_or_method    <built-in function
hypot>
i                               int                           9999
isaret                          str                           1
isaret10                        int                           -1
isaretliSayi                    float                         -1.234
isinf                           builtin_function_or_method    <built-in function
isinf>
isnan                           builtin_function_or_method    <built-in function
isnan>
kacBit                          int                           128
kalan                           int                           1
ldexp                           builtin_function_or_method    <built-in function
ldexp>
lgamma                          builtin_function_or_method    <built-in function
lgamma>
log                             builtin_function_or_method    <built-in function
log>
log10                           builtin_function_or_method    <built-in function
```

```
log10>
log1p                          builtin_function_or_method    <built-in function
log1p>
mantis                         float                         0.234
matplotlib                     module                        <module
'matplotlib' from<…>matplotlib/__init__.pyc'>
modf                           builtin_function_or_method    <built-in function
modf>
ondalik10                      float                         0.6
ondalik2                       str
00111011111001110110110011<…>00000000000000000000000000
ondalik2List                   list                          n=112
ondalik2den10a                 float                         0.234
ondalikBit                     int                           112
pi                             float                         3.14159265359
pow                            builtin_function_or_method    <built-in function
pow>
radians                        builtin_function_or_method    <built-in function
radians>
sayi10                         float                         1.234
sayi2den10a                    float                         -1.234
sgn                            function                      <function sgn at
0x7f2381030398>
sin                            builtin_function_or_method    <built-in function
sin>
sinh                           builtin_function_or_method    <built-in function
sinh>
sqrt                           builtin_function_or_method    <built-in function
sqrt>
taban                          int                           2
tamSayi10                      int                           -13
tamSayi2                       str                           11111111111111
tan                            builtin_function_or_method    <built-in function
tan>
tanh                           builtin_function_or_method    <built-in function
tanh>
toplam                         float                         1.1
trunc                          builtin_function_or_method    <built-in function
trunc>
us                             int                           0
us2lik                         int                           16383
usBit                          int                           15
x                              int                           -3
y                              float                         0.1
```

[26]:
```
2004**.5 - 2003**.5
```

[26]: 0.011170569998292024

[27]:
```
1./(2004**.5 + 2003**.5)
```

[27]: 0.011170569998288152

[28]:
```
0.011170569998292024
0.011170569998288152
```

[28]: 0.011170569998288152

[29]:
```
for i in range(1, 20):
    buyukSayi = 2*10**i
    sayi1 = buyukSayi + 3
    sayi2 = buyukSayi + 4
    fark1 = sayi2**.5 - sayi1**.5
    toplam = sayi2**.5 + sayi1**.5
    fark2 = 1/toplam
    hata = fark2-fark1
    print "%20s %25.24s %25.24s %25.24s"%(buyukSayi, fark1, fark2, hata)
```

```
                  20            0.103147962254            0.103147962254
1.38777878078e-17
                 200            0.0350500083107            0.0350500083107
-1.55431223448e-15
                2000            0.0111705699983            0.0111705699983
-3.87190279838e-15
               20000           0.00353522458758           0.00353522458759
9.60516388648e-15
              200000           0.00111802420605           0.00111802420608
3.13141439862e-14
             2000000          0.000353553081368          0.000353553081234
-1.33397524797e-13
            20000000            0.0001118033897          0.000111803389092
-6.07878032849e-13
           200000000          3.53553386958e-05            3.535533875e-05
5.41598490773e-14
          2000000000          1.11803456093e-05          1.11803398777e-05
-5.73160231299e-12
         20000000000          3.53553332388e-06          3.53553390562e-06
5.81739367744e-13
        200000000000          1.11799454316e-06          1.11803398874e-06
3.94455751435e-11
       2000000000000          3.53436917067e-07          3.53553390593e-07
1.1647352639e-10
      20000000000000          1.11758708954e-07          1.11803398875e-07
4.46899211223e-11
```

```
     200000000000000         3.53902578354e-08         3.53553390593e-08
-3.49187760611e-11
    2000000000000000         1.49011611938e-08         1.11803398875e-08
-3.72082130635e-09
   20000000000000000                       0.0         3.53553390593e-09
3.53553390593e-09
  200000000000000000                       0.0         1.11803398875e-09
1.11803398875e-09
 2000000000000000000                       0.0         3.53553390593e-10
3.53553390593e-10
20000000000000000000                       0.0         1.11803398875e-10
1.11803398875e-10
```

[30]:
```
import sympy as sym
sayi1N = sym.N(sayi1,100)
sayi2N = sym.N(sayi2,100)

sayi1Nr = sayi1N**sym.Rational(1,2)
sayi2Nr = sayi2N**sym.Rational(1,2)

sayi1Ns = sym.sqrt(sayi1N)
sayi2Ns = sym.sqrt(sayi2N)

farkR = sayi2Nr - sayi1Nr
farkS = sayi2Ns - sayi1Ns

farkBr = sym.N(1,100)/(sayi2Nr + sayi1Nr)
farkBs = sym.N(1,100)/(sayi2Ns + sayi1Ns)

print sayi1N
print sayi2N
print sayi1Nr
print sayi1Ns
print sayi2Nr
print sayi2Ns
print farkR
print farkS
print farkBr
print farkBs
```

```
2000000000000000003.00000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000
2000000000000000004.00000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000
4472135954.99957939315375753408752092533003488715930656681652898405416500486997508927364990646184360 2
4472135954.99957939315375753408752092533003488715930656681652898405416500486997508927364990646184360 2
```

```
4472135954.999579393265560932962510410140710773194308798668062494033534023471512
729486361547165845160
4472135954.999579393265560932962510410140710773194308798668062494033534023471512
729486361547165845160
0.000000000111803398874989484810675886035002231851533509979369018601537640212711
640704001558606842927643840078 7
0.000000000111803398874989484810675886035002231851533509979369018601537640212711
640704001558606842927643840078 7
0.000000000111803398874989484810675886035002231851533509979369018601537640212711
640704001558615759178609349936 7
0.000000000111803398874989484810675886035002231851533509979369018601537640212711
640704001558615759178609349936 7
```

4 ALIŞTIRMALAR

[31]:
```
# En basit şekilde kütüphane aşağıdaki gibi çağırılır
import math

math.cos(3.14159)
```

[31]:
```
-0.9999999999964793
```

4.0.1 1.3 - Fonksiyonlar

[32]:
```
def f(x):
    return x*((x+1)**.5 - x**.5)

def g(x):
    return x/((x+1)**.5 + x**.5)

sayi = 100000.
fark = f(sayi) - g(sayi)
print "%34.30f %34.30f %34.30f"%(f(sayi), g(sayi), fark)
```

```
158.113487725586310261860489845276 158.113487725687832607945892959833
-0.000000000101522346085403114557
```

4.0.2 1.4 - Başka fonksiyonlar

[33]:
```
# help(math)
```

[34]:
```
from math import *
x = 0.001
```

```
print 1 - cos(x)

x = 1000
print log(x+1) - log(x)

x = 0.249*math.pi
print cos(x)**2 - sin(x)**2

x = 1000
print (x**2+1)**.5 - x

x = 0.249*math.pi
print sin(x) - cos(x)

x = 10
print exp(3*x) - 3*exp(2*x) + 5*exp(x) - 1
```

```
4.99999958326e-07
0.000999500333084
0.00628314396556
0.000499999875046
-0.00444287562991
1.06850191961e+13
```

4.0.3 1.5 polinom kökleri

[35]:
```
a = 1.
b = 1000.001
c = 1.
delta = (b**2 - 4*a*c)**.5
x1 = (-b - delta)/(2*a)
x2 = (-b + delta)/(2*a)
x2c = c/x1
print x1
print x2
print x2c
```

```
-1000.0
-0.000999999999976
-0.001
```

[36]:
```
def kok(a,b,c):
    delta = (b**2 - 4*a*c)**.5
    x1 = (-b - delta)/(2*a)
    x2 = (-b + delta)/(2*a)
    return x1, x2
```

[37]:
```
print kok(1., 1000.001, 1.)
print kok(1., -4, 3.999999)
```

```
(-1000.0, -0.0009999999999763531)
(1.9989999999999302, 2.00100000000007)
```

[38]:
```
sart = True
while sart==True:
    a = complex(raw_input('a'))
    b = complex(raw_input('b'))
    c = complex(raw_input('c'))
    print kok(a,b,c)
    devam_mi = raw_input(u'Devam mı?(E/H)')
    if devam_mi.upper()!='E':
        sart = False
```

```
a 1b 2c 3((-1-1.4142135623730951j), (-0.9999999999999999+1.4142135623730951j))
RGV2YW0gbcSxPyhFLOgp
 Ea 2b 3c 4((-0.7500000000000001-1.1989578808281798j),
(-0.7499999999999999+1.1989578808281798j))
RGV2YW0gbcSxPyhFLOgp
 h
```

4.0.4 1.6 Binom dağılımı

4.1 $\binom{n}{m} = \frac{n!}{m!(n-m)!}$

[39]:
```
n = 100
m = 98

pay = 1
for i in range(1, n+1):
    pay = pay*i

paydaM = 1
for i in range(1, m+1):
    paydaM = paydaM*i

paydaNM = 1
for i in range(1, (n-m)+1):
    paydaNM = paydaNM*i

sonuc = pay/float(paydaM*paydaNM)
print pay
print paydaM
print paydaNM
```

```
print sonuc
```

```
933262154439441526816992388562667004907159682643816214685929638952175999932299156089414639761565182862536979208272237582511852109168640000000000000000000000000942689044888324774562618574305724247380969376407895166349423877729470707002322379888297615920772911982360585058860846042941264756736000000000000000000000000
2
4950.0
```

[40]:
```
# faktöryel hesaplama 1. yöntem

n = 5
faktoryel = 1
i = 0
while i<n:
    i += 1
    faktoryel = faktoryel*i

print faktoryel
```

```
120
```

[41]:
```
# faktöryel hesaplama 2. yöntem
n = 50
m = 46
faktoryel = 1
for i in range(1, m+1):
    faktoryel = faktoryel * (n-i+1)/float(i)

print faktoryel
```

```
230300.0
```

4.1.1 1.7 Fibonacci

[42]:
```
# Fibonacci 1. yöntem
n = 100

F1 = F0 = 1
print F1, F0,

i = 0
while i<n-1:
    F2 = F1 + F0
    F0 = F1
    F1 = F2
    print F2,
```

```
    i = i + 1
```

```
1 1 2 3 5 8 13 21 34 55 89 144 233 377 610 987 1597 2584 4181 6765 10946 17711
28657 46368 75025 121393 196418 317811 514229 832040 1346269 2178309 3524578
5702887 9227465 14930352 24157817 39088169 63245986 102334155 165580141
267914296 433494437 701408733 1134903170 1836311903 2971215073 4807526976
7778742049 12586269025 20365011074 32951280099 53316291173 86267571272
139583862445 225851433717 365435296162 591286729879 956722026041 1548008755920
2504730781961 4052739537881 6557470319842 10610209857723 17167680177565
27777890035288 44945570212853 72723460248141 117669030460994 190392490709135
308061521170129 498454011879264 806515533049393 1304969544928657
2111485077978050 3416454622906707 5527939700884757 8944394323791464
14472334024676221 23416728348467685 37889062373143906 61305790721611591
99194853094755497 160500643816367088 259695496911122585 420196140727489673
679891637638612258 1100087778366101931 1779979416004714189 2880067194370816120
4660046610375530309 7540113804746346429 12200160415121876738
19740274219868223167 31940434634990099905 51680708854858323072
83621143489848422977 135301852344706746049 218922995834555169026
354224848179261915075 573147844013817084101
```

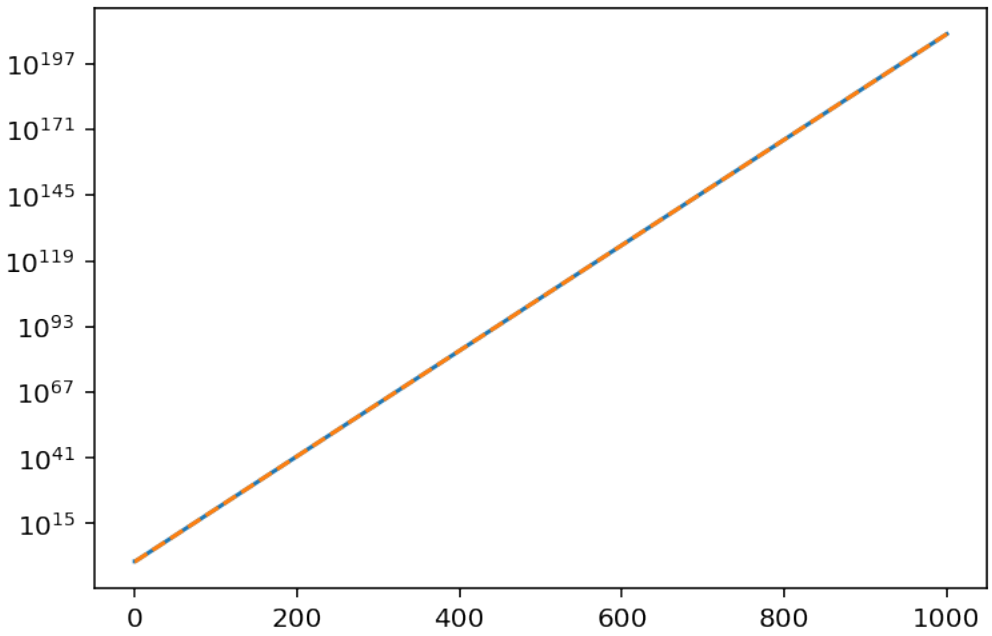
[43]:
```
# Fibonacci 2. yöntem

n = 101
Fn = (((1+5**.5)/2)**n - ((1-5**.5)/2)**n)/5**.5

print "%25.2f"%Fn
```

```
 573147844013818970112.00
```

[44]:
```
# Fibonacci 1. ve 2. yöntemin grafikleri

from math import log
import matplotlib.pyplot as plt
import numpy as np
%matplotlib inline

n = 1000

Fn = [1, 1]
i = 0
while i<n-1:
    Fn += [Fn[-1] + Fn[-2]]
    i = i + 1

FnLog = [log(F,10) for F in Fn]

Fnf = lambda n: (((1+5**.5)/2)**n - ((1-5**.5)/2)**n)/5**.5
```

```
Fnn = [Fnf(i) for i in range(1, n+2)]
FnnLog = [log(F,10) for F in Fnn]

plt.semilogy(Fn)
plt.plot(Fnn, '--')
plt.show()
```

[44]:



[0]: