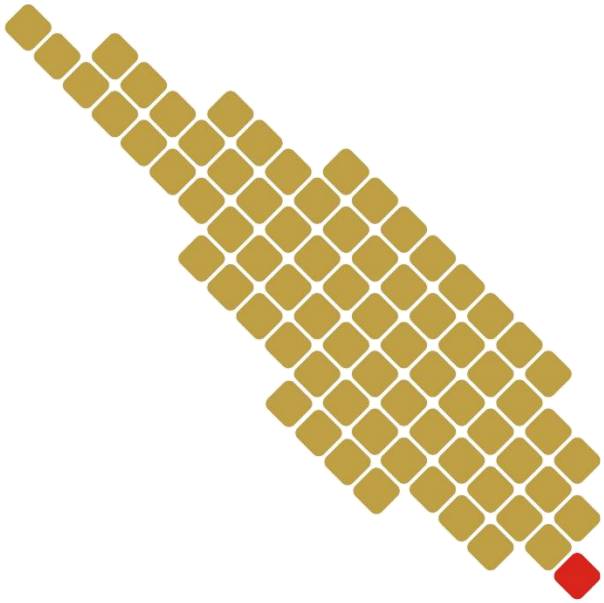
Laporan Akhir Praktikum

Pemograman Berbasis Fungsi



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LATIHAN SOAL

Chapter 9

May 16, 2022

0.1 1. Buat program untuk menghitung deret bilangan prima dari 2 hingga N menggunakan HOF filter dan map

[10]:
```
def factor(N):
    return list(filter(lambda x: N%x == 0, range(1,N+1)))
def primes(N):
    return list(filter(lambda x: len(factor(x))  == 2 , range(1,N+1)))

print(primes(100))
```

```
[2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73,
79, 83, 89, 97]
```

0.2 2. Terdapat dictionary employee berisi nama dan umur pegawai, lakukan filter untuk mengetahui pegawai yang berumur > 25 tahun !

[11]:
```
employee = {
            'Nagao':35,
            'Ishii':30,
            'Kazutomo':20,
            'Saito':25,
            'Hidemi':29}
```

[18]:
```
def age_morethan(dictionary, age):
    return list(filter(lambda x: x[1] > age, dictionary.items()))
def emp_res(dictionary, age):
    return [i[0] for i in age_morethan(dictionary, age)]

print(* emp_res(employee,25))
```

```
Nagao Ishii Hidemi
```

Chapter 10

May 16, 2022

0.1 1. Buat fungsi mencari jumlah bilangan genap dari list L!

[1]:
```
L = [2,1,9,10,3,90,15]
```

[4]:
```
from functools import reduce as r

def total_genap(l):
    return r(lambda a,b: a+1 if b%2 == 0 else a, l,0)

total_genap(L)
```

[4]: 3

0.2 2. Buat fungsi untuk menghitung n! Menggunakan reduce!

[11]:
```
def faktorial(n):
    return r(lambda a,b: a*b, range(1,n+1))

faktorial(6)
```

[11]: 720

0.3 3. Hitung euclidian distance dari dua vektor berikut menggunakan higher order function!

[16]:
```
x = [2,5,6,7,10]
y = [-2, 9,2,-1,10]

def euclid_distance(x,y):
  res = list(map (lambda x,y: (x-y)**2 , x,y  ) )
  return (r (lambda a,b : a + b, res,0) ) **(1/2)

print(euclid_distance(x,y))
```

```
10.583005244258363
```

0.4 4. Terdapat dictionary employee berisi nama dan umur pegawai, lakukan reduce untuk mengetahui berapa jumlah pegawai yang berumur > 25 tahun !

[18]:
```
employee = {
    'Nagao' : 35,
    'Ishii' : 30,
    'Kazutomo' : 20,
    'Saito' : 25,
    'Hidemi' : 29
    }

def emp_agemorethan(dictionary, age):
    return r(lambda a,b: a + 1 if b[1] > age else a, dictionary.items(), 0 )

emp_agemorethan(employee,  25)
```

[18]:
```
3
```

0.5 4. Buatlah deret fibonacci menggunakan higher order function!

[19]:
```
fibo_seq = lambda n: r(lambda x, _: x + [x[-1] + x[-2]], range(n-2), [0,1])
print(fibo_seq(10))
```

```
[0, 1, 1, 2, 3, 5, 8, 13, 21, 34]
```

Chapter 11

May 16, 2022

0.1 Buat sebuah program untuk membuat deret fibonacci dari 0 hingga N dengan menggunakan fungsi non-rekursif dan rekursif!

Bandingkan keduanya jika nilai N = 500, Manakah yang lebih baik? Jelaskan!

Rekursif

[4]:
```
def fibo_rec(N):
    if N <= 1:
        return N
    else:
        return(fibo_rec(N-1) + fibo_rec(N-2))
def fibonacci_seq(N):
    return [fibo_rec(i) for i in range(1,N+1)]
```

[14]:
```
fibonacci_seq(10)
```

[14]:
```
[1, 1, 2, 3, 5, 8, 13, 21, 34, 55]
```

0.1.1 fibonacci_seq(500) Loadingnya terlalu lama, sampai saya kira laptop saya rusak

Non-Rekursif

[3]:
```
from functools import reduce as r

fibo_seq = lambda n: r(lambda x, _: x + [x[-1] + x[-2]], range(n-2), [0,1])
print(fibo_seq(500)) #Waktu yang dibutuhkan sangat singkat (tidak sampai 1␣
 ↪detik)
```

```
[0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584,
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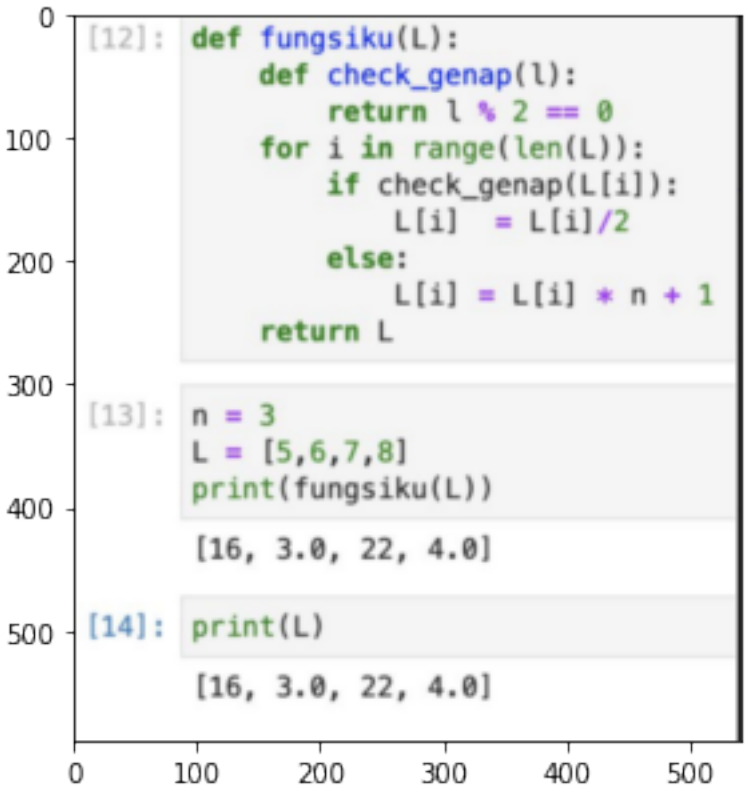
Chapter 12

May 16, 2022

0.1 1. Ubah fungsiku menjadi pure function!

[9]:
```
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
img = mpimg.imread('12_no 1.png')

fig, ax = plt.subplots(figsize=(10, 5))
plt.imshow(img)
plt.show()
```



[12]:
```
def fungsiku(L):
    def check_genap(l):
```

```
        return l % 2 == 0
    return list(map(lambda l: l/2 if check_genap(l) else l * n + 1, L))

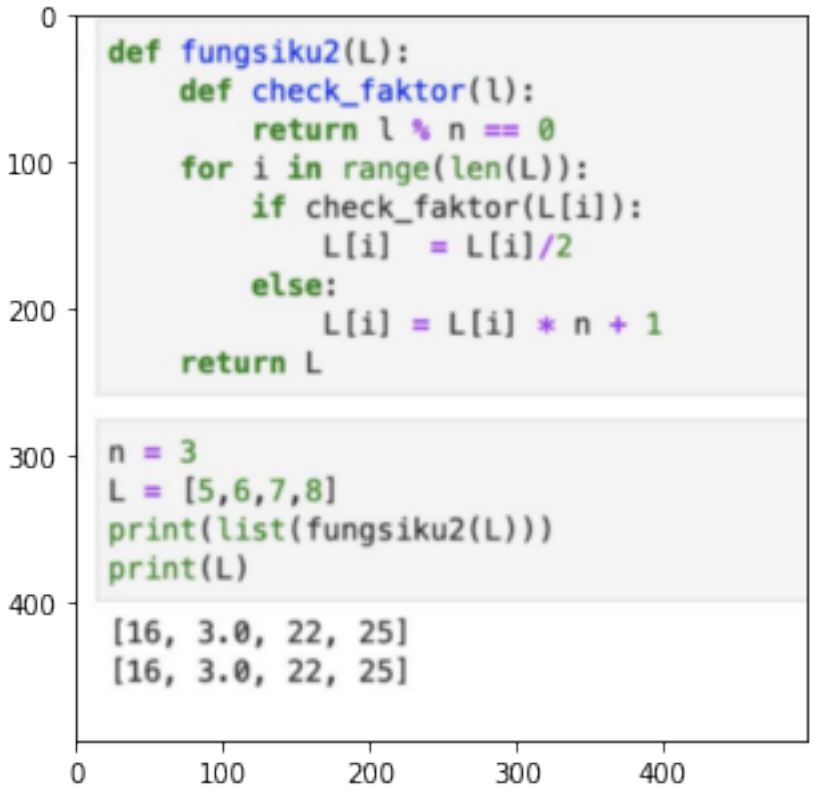
n = 3
X = [5,6,7,8]
print(fungsiku(X))
print(X)
```

```
[16, 3.0, 22, 4.0]
[5, 6, 7, 8]
```

0.2 2. Ubah fungsiku2 menjadi pure function!

[10]:
```
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
img = mpimg.imread('12_no 2.png')

fig, ax = plt.subplots(figsize=(10, 5))
plt.imshow(img)
plt.show()
```



[11]:
```
def fungsiku2(L):
    def check_faktor(l):
        return l % n == 0
    return list(map(lambda l: l/2 if check_faktor(l) else l * n + 1, L))

n = 3
L = [5,6,7,8]
print(fungsiku(L))
print(L)
```

```
[16, 3.0, 22, 4.0]
[5, 6, 7, 8]
```

0.3 3. Apakah isi dalam tupel tup ada yang dapat diubah?

[14]:
```
tup = ([3, 4, 5], 'myname')
tup
```

[14]:
```
([3, 4, 5], 'myname')
```

Ada, yaitu elemen list dalam tuple

[17]:
```
tup[0][2] = 8
tup
```

[17]:
```
([3, 4, 8], 'myname')
```

Chapter 13

May 16, 2022

0.1 1. Latihan 1

[1]:
```
Addku = lambda x:x+10
Powku = lambda x:x**2
Kurku = lambda x:x-2*x
```

a. Buatlah fungsi komposisi menggunakan 3 fungsi diatas yang melakukan hal sebagai berikut secara berurut:

1. Menjumlahkan input dengan nilai 10
2. Mengurangi input dengan 2 kali input nya
3. Mengeluarkan nilai kuadrat dari input nya

[2]:
```
#compost_1 =compost_func(Powku,Addku)
#compost_2 =compost_func(Kurku, compost_1)
compost_func =lambda f,g: lambda x: f(g(x))
comp_func_f = compost_func(Kurku, compost_func(Powku, Addku))


print(comp_func_f(10))
```

```
-400
```

B. Buatlah fungsi invers nya!

[3]:
```
inv_add = lambda x: x-10
inv_pow = lambda x: x**(0.5)
inv_kur = lambda x: -1 *  x
```

[4]:
```
inv_compost_func =lambda f,g: lambda x: f(g(x))
inv_comp_func_f = inv_compost_func(inv_add, compost_func(inv_pow, inv_kur))

print(inv_comp_func_f(-400))
```

```
10.0
```

0.2 2. Latihan Penentuan UKT Mahasiswa

[23]:
```
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
img = mpimg.imread('chp13=pbf.png')

fig, ax = plt.subplots(figsize=(15, 10))
plt.imshow(img)
plt.show()
```

[5]:
```
from functools import reduce as r
```

[6]:
```
mhs = [3, [120000, 75000, 50000], 5.5*10**6, False]
```

Tanpa Fungsi Komposisi

[7]:
```
def skor_1(X):
    return 1 if X[0] >= 5 else 5-X[0]
def skor_2(X):
    def rata2(X):
        return sum(X[1])/len(X[1])
    def skor(X):
        return 3 if rata2(X) >= 100000 else 2 if rata2(X) >= 50000 else 1
    return skor(X)
def skor_3(X):
    return 7 if X[2] > 10*10**6 else 6 if X[2] > 8*10**6 else 5 if X[2] >␣
 ↪6*10**6 else 4 if X[2] > 4*10**6 else 3 if X[2] > 3*10**6 else 2
def skor_4(X= True):
    return 1 if X[3] == True else 5
def skor(X):
    return 0.2 * skor_1(X) + 0.3 * skor_2(X) + 0.2 * skor_3(X) + 0.3 * skor_4(X)
def total_UKT(X):
    return 75*10**4 + skor(X) * 5*10**5
```

[8]:
```
total_UKT(mhs)
```

[8]:
```
2400000.0
```

Dengan fungsi Komposisi

[9]:
```
compose_func = lambda *funcs: r(lambda f,g : lambda x:f(g(x)), reversed(funcs),␣
 ↪lambda x:x)
```

[10]:
```
#Jumlah tanggungan
def skor1(jtg):
    return 1 if jtg >= 5 else 5-jtg
#Token Listrik
def skor2(X):
    def rata2(X):
        return sum(X)/len(X)
    def l_cond_1(X):
        return [X, [X>100000]]
    def l_cond_2(X):
        return [X[0], X[1]+[X[0] >= 50000]]
    def to_score2(X):
        return r( lambda a,b: a+(1 if b==True else 0), X[1], 1)
    compose_skor2 = compose_func(rata2, l_cond_1, l_cond_2, to_score2)
    return compose_skor2(X)
#Ketentuan Gaji
def skor3(gaji):
    def con_1(X):
        return [X[0], 1, X[2], [ X[0] > X[2][X[1] ] ] ]
```

```
    def con_2_to_n(X):
        return [X[0], X[1] + 1, X[2], X[3] + [X[0] > X[2][X[1] ] ] ]
    def to_score(X):
        return r(lambda a,b: a + (1 if b==True else 0), X[-1], 2)
    def prep(gaji):
        return [gaji, 0 , list(map(lambda x:x*10**6, list(range(10,3,-2)) +␣
 ↪[3]) )]
    comp_skor3 = compose_func(prep, con_1, *(con_2_to_n for i in range(4)),␣
 ↪to_score)
    return comp_skor3(gaji)
```

[11]:
```
#Ket KIP-K
def skor4(X=True):
    return 1 if X else 5
```

[12]:
```
def combineskor(X):
    return X + [map( lambda f,x: f(x), X[1], X[0])]
def bobot(X):
    return r(lambda a,b: a+b, map( lambda x,y:x*y, X[-1], [0.2,0.3,0.2,0.3]))
def to_UKT(X):
    return 750000+X*500000
```

[13]:
```
datas = [mhs, [skor1, skor2, skor3, skor4]]
compose_final = compose_func(combineskor, bobot, to_UKT)
compose_final(datas)
```

[13]:
```
2400000.0
```

0.3 3. Turunan Polinom

[14]:
```
def splt(dat):
    return dat.replace(' ','').replace('-', '+-').split('+')
def chdepan(dat):
    return dat[1:] if dat[0] == '' else dat
def eqkan(dat):
    return map(lambda x: x if '^' in x else x + '^1' if 'x' in x else␣
 ↪x+'x^0',dat)
def toarr2d(dat):
    return r(lambda a,b: a + [ [ float(hurf) for hurf in b.split('x^')]], dat,␣
 ↪[])
def sortdesc(dat):
    return sorted(dat, key=lambda x:x[1], reverse=True)
def calctur(dat):
    return map(lambda x: [0,0] if x[1] == 0 else [ x[1] * x[0], x[1]-1], dat)
def tostr(dat):
```

```
    return map(lambda x: '0' if x[0] == 0 else str(x[0]) if x[1] ==0 else␣
 ↪str(x[0]) + 'x' if x[1] == 1 else str(x[0]) + 'x^' + str(x[1]), dat)
def prettykan(dat):
    return r(lambda a,b : a+ '+' + b if b!='0' else a, dat, '')
def prettysign(dat):
    return dat.replace('+-', ' -').replace('+', ' + ')
```

[15]:
```
dat = '-3x^5 + 2x^2 - 4x + 5'
fss = (splt, chdepan, eqkan, toarr2d, sortdesc, calctur, tostr, prettykan,␣
 ↪prettysign)
turunan = compose_func(*fss)
```

[21]:
```
print(turunan(dat))
```

```
-15.0x^4.0 + 4.0x -4.0
```

0.4 4. Buatlah fungsi untuk menghitung biaya yang harus dibayar customer pada suatu e-commerce menggunakan higher order function.

Buatlah decorator untuk mengeluarkan harga sebelum pajak dan sesudah pajak (pajak = 11%) ! Gunakan decorator untuk menambahkan perhitungan waktu eksekusi!

[17]:
```
keranjang = [
    {'jumlah_barang' : 5, 'harga' : 10},
    {'jumlah_barang' : 7, 'harga' : 20},
    {'jumlah_barang' : 20, 'harga' : 4.5}
]
```

[18]:
```
def pajak(func):
    def inner(*args, **kwargs):
        res = func(*args, **kwargs)
        print('subtotal : ', res)
        print('pajak:', res* 0.11)
        print('total:', res + res*0.11)
        return res
    return inner

def calc_time(fn):
    from time import perf_counter
    def inner(*args, **kwargs):
        start_time = perf_counter()
        to_execute = fn(*args, **kwargs)
        end_time = perf_counter()
        execution_time = end_time - start_time
        print('Execution Time : {0:.8f}s'.format(execution_time))
        return to_execute
    return inner
```

[19]:
```
@calc_time
@pajak
def total_pembayaran(keranjang):
    return r( lambda a,b: a+ (b['jumlah_barang'] * b['harga']), keranjang, 0) *␣
↪1000
```

[20]:
```
total_pembayaran(keranjang)
```

```
subtotal :  280000.0
pajak: 30800.0
total: 310800.0
Execution Time : 0.00015180s
```

[20]:
```
280000.0
```

Chapter 14

May 16, 2022

0.1 1. Buatlah fungsi untuk menampilkan bilangan fibonacci ke-101 dengan menggunakan konsep lazy evaluation!

[10]:
```
def fibo_gen():
    yield 0
    a, b = 0, 1
    while True:
        yield b
        a,b = b, a+b
```

[18]:
```
from itertools import islice
list(islice(fibo_gen(), 101,102))
```

[18]:
```
[573147844013817084101]
```

JURNAL MODUL

Jurnal Modul 1

May 16, 2022

Seorang mahasiswa sains data ingin menyewa buku dari sebuah startup yang menyediakan layanan sewa buku. Startup tersebut memiliki ketentuan sewa dengan aturan sebagai berikut: - Harga sewa buku berbeda-beda sesuai dengan kategorinya - Harga sewa buku dihitung berdasarkan jumlah halaman nya - Harga sewa buku dihitung per hari nya - Maksimal durasi sewa adalah 26 hari

Startup tersebut masih dalam tahap awal pengembangan, sehingga ingin melakukan uji coba penyewaan 5 kategori buku. Berikut rincian kategori nya:

- Kategori 1 : 100 rupiah per lembar per hari
- Kategori 2 : 200 rupiah per lembar per hari
- Kategori 3 : 250 rupiah per lembar per hari
- Kategori 4 : 300 rupiah per lembar per hari
- Kategori 5 : 500 rupiah per lembar per hari

Startup tersebut memerlukan sebuah program untuk: - menghitung total biaya dari customer - mencatat tanggal awal sewa, dan durasi hari - menampilkan informasi kapan tanggal pengembalian buku dari customer

Format input tanggal adalah yyyy-mm-dd Bantulah startup tersebut membuat program tersebut dengan menggunakan konsep modularisasi!

[1]:
```
def tgl_list(tgl): #memisahkan tanggal. bulan, dan tahun
    return [int(i) for i in tgl_pinjam.split('-')]

def is_kabisat(tgl): #mengecek apakah tahun tersebut kabisat
    return ( tgl_list(tgl)[0] % 100 == 0 and tgl_list(tgl)[0] % 400 == 0 ) or␣
 ↪(tgl_list(tgl)[0] % 100 != 0 and tgl_list(tgl)[0] % 4 == 0)

def monthh(tgl): #menentukan jumlah hari dalam suatu bulan
    return 29 if tgl_list(tgl)[1] == 2 and is_kabisat(tgl) else 28 if␣
 ↪tgl_list(tgl)[1] == 2 and not is_kabisat(tgl) else 30 if tgl_list(tgl)[1] %␣
 ↪2 == 0 and tgl_list(tgl)[1] <= 7 else 31 if tgl_list(tgl)[1] % 2 == 1 and␣
 ↪tgl_list(tgl)[1] <= 7 else 30 if tgl_list(tgl)[1] % 2 == 1 and␣
 ↪tgl_list(tgl)[1] > 7 else 31

def is_newmonth(tgl, durasi): #menentukan apakah terjadi pergantian bulan
    return tgl_list(tgl)[2] + durasi > monthh(tgl)

def is_newyear(tgl, durasi): #menentukan apakah terjadi pergantian tahun
    return tgl_list(tgl)[1] == 12 and is_newmonth(tgl, durasi)
```

```
def tgl_kembali(tgl, durasi): #menentukan tanggal buku harus dikembalikan
    return [tgl_list(tgl)[0] + 1, tgl_list(tgl)[1]+1, (tgl_list(tgl)[2] +␣
 ↪durasi) - monthh(tgl) ] if is_newyear( tgl, durasi) and is_newmonth(tgl,␣
 ↪durasi) else [tgl_list(tgl)[0], tgl_list(tgl)[1]+1, (tgl_list(tgl)[2] +␣
 ↪durasi) - monthh(tgl) ] if is_newmonth(tgl, durasi) else [tgl_list(tgl)[0],␣
 ↪tgl_list(tgl)[1], (tgl_list(tgl)[2] + durasi) ]

def tgl_pengembalian(tgl, durasi): #menggabungkan tanggal, bulan, dan tahun␣
 ↪tanggal pengembalian
    return '-'.join([str(i) for i in tgl_kembali(tgl, durasi)])

def biaya_per_kategori(rincian_buku, rincian_kategori): #menghitung biaya buku␣
 ↪per kategori
    return list(map(lambda x, y: x[1] * rincian_kategori.get(x[0]),␣
 ↪rincian_buku, rincian_kategori))

def biaya_total(rincian_buku, rincian_kategori, durasi): #menghitung biaya total
    return sum(biaya_per_kategori(rincian_buku, rincian_kategori)) * durasi
```

[2]:
```
rincian_kategori = {
    1 : 100,
    2 : 200,
    3 : 250,
    4 : 300,
    5 : 500
    }
```

[8]:
```
tgl_pinjam = input('Masukkan tanggal peminjaman (YYYY-MM-DD): ')
durasi = int(input('Masukkan durasi peminjaman (hari) : '))
```

```
Masukkan tanggal peminjaman (YYYY-MM-DD): 2022-06-15
Masukkan durasi peminjaman (hari) : 25
```

[6]:
```
#[kategori, halaman]
rincian_buku = [[3, 6], [2, 5], [4, 3], [1, 5], [5,10]]
```

[10]:
```
def book_fee(tgl_pinjam, durasi, rincian_buku, rincian_kategori =␣
 ↪rincian_kategori):
    print(f'Biaya yang harus dibayar adalah Rp.{biaya_total(rincian_buku,␣
 ↪rincian_kategori, durasi)} dengan tanggal pengembalian␣
 ↪{tgl_pengembalian(tgl_pinjam, durasi)}  ')
```

[11]:
```
book_fee(tgl_pinjam, durasi, rincian_buku)
```

```
Biaya yang harus dibayar adalah Rp.222500 dengan tanggal pengembalian 2022-7-10
```

Jurnal Modul 2

May 16, 2022

0.0.1 1. Buatlah sebuah fungsi bernama ulangi_NIM, ulangi memiliki input sebuah bilangan skalar a, dan mengeluarkan vektor 1xn dengan seluruh elemen nya adalah a !

[2]:
```
def ulangi_065(a): #Mapping mereturn vektor 1xa dengan seluruh elemennya adalah␣
↪a
    return list(map(lambda x: a, range(a)))
```

[3]:
```
ulangi_065(5)
```

[3]:
```
[5, 5, 5, 5, 5]
```

0.0.2 2. Buatlah deret bilangan sebagai berikut dengan input n sebagai panjang deret:

[4]:
```
def deret(n): #Menghitung deret sebanyak n deret
    return list(map(lambda n: (-1)**n*(1/2**(n+1)), range(n+1)))
```

[5]:
```
deret(5)
```

[5]:
```
[0.5, -0.25, 0.125, -0.0625, 0.03125, -0.015625]
```

0.0.3 3. Jumlahkan deret bilangan tersebut!

[6]:
```
from functools import reduce as r
```

[7]:
```
def add(a,b): #fungsi untuk menambahkan setiap elemen list dengan reduce
    return a+b
r(add, deret(5))
```

[7]:
```
0.328125
```

0.0.4 4. Sebuah DNA dimodelkan dalam sebuah string menjadi sequence TCGA dan disimpan ke dalam data :

[8]:
```
dna_data = open('DNA.txt', 'r')
dna = dna_data.read() #membaca seluruh isi file .txt
```

[9]:
```
def split_txt(txt, dna): #membagi kumpulan kode DNA sesuai jumlah karakter pola␣
 ↪yang dicari
    return [txt[i:i+len(dna)] for i in range(len(txt))]
def pattern(txt, dna): #memfilter kode DNA yang telah dibagi yang sesuai dengan␣
 ↪pola yang dicari
    return list(filter(lambda x: x == dna, split_txt(txt, dna)))
def counting_pattern(txt, dna): #menghitung jumlah DNA yang sesuai dengan pola␣
 ↪DNA
    return len(pattern(txt, dna))
def count_all_pattern(txt, sequences): #Menghitung jumlah DNA jika pola yang␣
 ↪dicari lebih dari 1
    return map(lambda x: counting_pattern(txt,x), sequences)
```

hitunglah jumlah kemunculan pola berikut pada data tersebut: 1. A 2. AT 3. GGT 4. AAGC 5. AGCTA

[10]:
```
sequences = ['A', 'AT', 'GGT', 'AAGC', 'AGCTA']
```

[11]:
```
print(* count_all_pattern(dna, sequences))
```

```
2112 557 77 22 5
```

==========

[12]:
```
def append_n(dat, i, n): #Menentukan pembagian kode dna
    return dat[i:i+n]
def remap(dat, seq):#membagi kumpulan kode DNA sesuai jumlah karakter pola yang␣
 ↪dicari
    return map(lambda x: append_n(dat, x, len(seq)), range(len(dat) - len(seq)␣
 ↪+ 1))
def count_mer(dat, seq): #menghitung jumlah DNA yang sesuai dengan pola DNA
    return r(lambda a,b : a + (1 if b == seq else 0), remap(dat, seq), 0)
```

[13]:
```
def count_all(dat, sequences): #Menghitung jumlah DNA jika pola yang dicari␣
 ↪lebih dari 1
    return map(lambda x: count_mer(dat,x), sequences)
print(* count_all(dna, sequences))
```

```
2112 557 77 22 5
```

5. Reverse complement dari suatu sequence string DNA memiliki aturan sebagai berikut:

- A adalah komplemen dari T
- C adalah komplemen dari G

[14]:
```
def komplemen(dna): #menukar value sesuai komplemennya
    return list(map(lambda x: 'A' if x == 'T' else('T' if x == 'A' else ('C' if␣
 ↪x == 'G' else ('G' if x == 'C' else x))), list(dna)))
def hasilkomplemen(dna):
    return ''.join(komplemen(dna)) #menggabungkan list menjadi string
```

[15]:
```
dna[:10]
```

[15]:
```
'TGTCTTCCGG'
```

[16]:
```
hasilkomplemen(dna)[:10]
```

[16]:
```
'ACAGAAGGCC'
```

[17]:
```
def komplemen2(x): #mendapatkan value dari key 'x'
    return {'A' : 'T', 'T' : 'A', 'C' : 'G', 'G' : 'C'}.get(x)
def reverse_komplemen(dna): #menukar nilai key dengan value jika memenuhi dict␣
 ↪komplemen2
    return map(lambda x: komplemen2(x), dna)
```

[18]:
```
print(* reverse_komplemen(dna))
```

```
A C A G A A G G C C G A C T C G C C A A G G A T T G G T C G T C T G A C T A T G
A C C A G C T T A T A G C T G C C C G T T C T C G G G A C C C T A A C T A C G C
A A A G T G G T A C G C G C A G A G T C A C G T C C G T C C T T A C G T C T C G
A A T G A A G T T T G A T C A A T G A C C G T T T T T T A T G T T T A A A A A A
G C T A G C T G G A A C T C A A A T A A G T A A T G G C G T G T C A G A A A A T
G G C G T G G A C A A T G G C G T G T A G G C A T T C A A A T G G C G T G C A A
T G G C G T G A T G G A G A G A T A T A A T G G C G T G A A G C A A A T G G C G
T G C G A C T C C T T G C C A A T G G C G T G A A T G G C G T G G T G T T C C A
C G C A C G A G A C A A T A A T G G C G T G G T G G T A A T G G C G T G C G T G
A A A A T A A T G G C G T G G T C C C G T G T C G G T G C A T C C C A T C G C A
G C A A G A G T G A C A T A A C G C C G C T G C C A G C A T T A A A T G G C G T
A A T G G C G T G G T G A G C A A T C G A A T G G C G T G G A T C C C A A C A A
T G G C G T G C T G A A T G G C G T G T C G G C A A T G G C G T G C A C A A T G
A A C T G C G A G A T T G A G G G T G A G T A T A G T C A G A A T A A T G G C G
T G T G A C C C G A A T G G C G T G G G C G T G G A A T T C A T C C G T C A A T
G G C G T G C A T A A T G G C G T G C A T T A A T G G C G T G T G G A C A T T T
C C G T C C C A T T T C A T G T C T G A A T G G C G A A T G G C G T G C C A A C
G T G G T G C T G T T T A G A T T G C A A T C C A T G C A A T G G C G T G C C C
T T T A A T G G C G T G A G G T C C C A A A A T G G C G T G T C T A T A G G T A
A G C C C T T A C A C T G G G G A C C T C A C C T C A A C A C G C T T T C T A T
G C C T C A A A A G T T C C C G T G T G G G T C G A T A C A A T A A T T C G C A
A T G T C A C C G G C G A C G T A G T A C A G T T A C A A G T C C A G T A A G A
G A T A G A A C G A T A C A T G C T T G G G A G C A A T T C T C C C T C A T T C
```

G C T A G A A A A C T G T T T T A G C A T A C G T A C A T C C G C T C C G T T A
C G G C T A A T G T A A C T T G C C G C C C T G A A A A A G C A T A C T C T G T G
G C G C C A A C T T T A T A A A A A A A A T A C G T T C T C G C C C T A A C C C G
C C T T C C T C T G A A T T G C G T C A C G G A T C G T G A C A A T T G A C G C
C G T A C C G G C C T A C C T G A T G G A T A A A A C G T C G A G G T C G C A A
A C T C A A G G T G C A T G A C T G C C T T G T C A G G G C T C T A T C C G G T
A C A C C A G C T A G G G T C A C T C T T T A C T C T G A G C T C T A C G G C C
A T G G C C A T C G T A G T G G T G T A A C G A G G T C A T A C T A T A G T C A
G A A G T G A C A G T C G T T A A T T A C G T C G C T A G A A C T T C T C T C A
A T A A G T A G A G A A T A G T G G A C T G T T A T T T A G T T A A A T G G T C
A G T T T A A G A G A A A T T G T A G C A C G G C T T G A C G C T A C G C A G C
A T C A G A T C T A A T C C T A T A T A A A A G A A T C G A C C G A A G C T A C
T A A C C G A C A T G C G A T T C C A C T A A C T T A A A G C T A G A C G T A A
C C T C G A C A T G G G G T G G A A C G T A C C G T A A C T G T C G G A T T T C
G C A C T T C T T A C G T T A T G T C G A C T G T C T T T T T A T T G C C C G A
G C T A T T G C A A G G T T C T A A G A C T G A A T T G C T G C C G A T C G C T
C G C T C A G T A T T T A G G G C A G G T G T G G C C C G T T A G C C C A G C C
T C A C C T T T C C C C G C C C T A A A A T A A T A A T G C A C T G C G T C T A G
A G G C A C A G T G A T A T G A G T G T A G G A G A G A C A T C T A T T T C A A
T A T G G T T G G A G G T A T A A G A A G A A T G C G A T T C A A G C C C G A T
A G G C T C A G A G C C G G G T A T C G T C C T C G T G A A A T T C C C T T C A
G G A T A A C G G C T T A T G T C A T G C A A G G G G C G T T A T A C A A T A T
G A G T G G G T T T A T A C A A T T A T A C A A T A T A C A A T T T T G C G T C
A C A C C C T T A T A T A C A A T T A T A C A A T A C A C T T A T A C A A T T T T A
T A C A A T T T T A T A C A A T T G C T A C A A T C G G C A C T A T T T A T A C
A A T A A T T G C C G C A C G C A A T T A T A C A A T C G C T G C T G A C C C C
C A G T T A T A C A A T C G G T T G A A G G A G T T A T A C A A T T G G C C A A
T T A T A C A A T C A A T T C T A G T T A T T T A T A C A A T C G A T G C A T C
T G T T A T T T T C G T A T T C G T T A T A C A A T A T T A T A C A A T C T G T
C A A G A G A T T G G C T A T T A T A C A A T T C C G T A T G A A T T G G T C G
C T T A C T G T C T T T A T A C A A T T A T A C A A T T T A T T T A T A C A A T
C T A T T A T A C A A T G C T A T A A T G G G C G T G T A A C G A G G C T T A T
A C T T A T A C A A T T C C A C C A A G A G G C A T A A A T T A T A A C A C T C
T C T A T C G A A C A C T C T C T A C A A C A A C A C T C T C T C G A C A C T C
T C G A A A C G G C T C G G A A A T T T A T A A C A C T C T C A A T A C A T C A G
C C G G A C A C T C T C T A C A C A C T C T C T C A A T T T A T A C A A T C A A
T C G A C T C T C G A T G C G A C A C T C T C C G C T T A A C T G C A T C A C G
A A A A A C A A G A C A C T C T C T A C A C A C T C T C A C A C T C T C G C G C
A C A C T C A C A C T C T C A C T A A C A C G T A C C A G G T C A T T C T A C A
C T C T C A C A C T C T C A C T A G A T T G C G A T A C A C A C T C T C T C C C
A C A C T C T C C G A C G C A T A C T T C G T G T T T A C A C T C T C A A C A C
T C T C T A T G C A A T T C T C G G G C C T T C G A G C C G T A G T A T T C G A
C T C G T C T A A G T T A C A C T C T C C C G C T C G G C T G C C A T C C G A C
A C T C T C A G T A A T A A C A C T C T C A G C G C A C C A C A C T C T C A G G
G T A A A A T A C A C T C T A C A C T C T C G A G A C C C C G A C A C T A C A C
T C T C T C A T G C G G C T T C G C A C A C T C T C A G G A C A C T C T C T C T A A
G C C T C C A G A C C T A C T G T A A C A C T C T C G G A C G A A T G C G C T G
C A C T A C T T G C G C T G G C T G A T C G C T G G C G G G T G A T G A T G A G

C G T C A A C C A G A T C T C C G T A A C G A A A T G A C T T T A T G C G T C C
T A C G A A T A C T G C G A G C G C G G T T A T G T A G C G C G A G C G T G A C
A T A C A G C G A A G T G G A A T T A G G A T T T C G A G T T T A T A T T G C C
T T T T T C T C T T T A A T C C T G C T G G C T C C C A G C A G G A G G C C A C
C A A A A G T G C T G A A G C G G T T A C C G C A C G A C G C A G C T T T A C A
C G A G T T T C G G G G C A T T T C G A G T C T G T G G T A C G T C C T T A C C
C T T A C A C A T G G G T C T C T A G G G A T C A T T C T C T C T A G G T T C T
G A A T T T C G G C A A G G C T C T C T C T A G A T T A G T G A T C T C T A G A
A T T G T G G T T A T C T C T A G G A G A T T C T C T A G T C A T C T C T A G C
G A A A A G T C T C T A T C T C T A G T G A G T G G C T C T C T A G A A T G T C
A A A C T A T A C A G T C A A G C C A A T T T T C G T C T C T A G C A G A C G T
C T C T A G C C A T C G C A T C T C T A G G G C A C A G C A T G T T T T T G A A
T C T C T A G T C T A G C G C G G A G C T T G A C A T G A A T C T C T A G A T G
T A A T A G A T T C T C T C T C T C T A G T C T C T A G T G T T C C G G T G T G T G
C T G T T T C A A T C T C T A G A T G T G T G C T A T C C A C C A C G G C T T G
G A C T C T C T A G G C C C A A A A C T C T C T C T A G T T C T C T A T C T C T
A G C A A T C T C T T C T C T A G A T C T C T A G C G T G C C C A A A A C C T C
T C T A G C A A G C C C C A A A A C A G C C C T T C T C T C T A A T T A C G C C A C T
C A A T T A C G C C C A T A T T A C G C C G T C T A T T A C A T T A C G C C A G
A T T A C A T T A C G C C C T C T A T T A C G C C A C T A C T T T G A A T T A C
G C C G A T T A C G C C A A T T A C G C C A G C T T G C G A T T A C G C C T C G
A T T A C G C C C C G C A T T G T A T T A C A T T A C G C C A A C A G T T A T A A
C A A A A A G T T A T A A T T A T A A G T T A A T G T T A T A A G T T T G C G T T
A T A A T T T G C C G G C C A T T A C G C C C C A G T T A G T T A T A A A A G C
A T T A C G C C C C C A A T T A C G C C A A A A A G T T A T A A T A G C C A T T A C
G C C C T C G A C C G T T A T A A C C A A A A A C C A T T A C G C C A A A T T A T
T A C G C C C C C G C T G T T A T A A C C C C A T T A C G C C T A T A A A T A G T T
A T A A C A C A A A A G T T A T A A A A T T G T G T T A T A A A C G G G C A T C C A T
A C T G G A T T A A T T A C G C C T A T A A T C C C C C G G T T A A T T A C G C C
T A G C A T T A C G C C C C A G C C C C G A A T A T T G T T A A T T A C G C C A G T
T A T A A T G A T T A C G A T T A C G C C C G C C T G A T G T T A T A A A T G T T
T T C T G A T G G T T A T T A C G C C T A T T A C G C C A G T T A T T A C G C C
T T C T A T T G C G C C C G T T A T A A C G G G C T G T T A T A A A C T G A T G T
G T T C T G A T G T G T T A T A A G G C A A T A A G A C A C G G T T G C G G T C
C A G T T A C G C A G C T T G G T T A T A A G A A C T A A C A C T A C G T C T G
A T G T G C T G A T G T T A T A A A T G G G G G C C C T G A T G T A T A G G T G
C T G A T G T C C C C G C T C T G A T G T A T C C C T G A T G T C T G A T G T T G
T T A A T A C C A G T G T A A T T G A G A C G G G C C G C C C G A G A A G G G A T
T T A G A G T G C A C T A C C T G A T C T G A T G T G G C T G A T G T T G T A T
G A A A C G T T G C T G A T G T C A T G C A A T T C T G A T G T C C T A A G T C
T G A T G T G A A C T A A A G G A C T G A T G T G A A G A C T G T T G G G C G T
G T A A C G G G G C G A T T G A G A C T A C C G G G G G T C T C T G A T G T A T G
G T A G C T C G C G C T G A T G T C C T G A T G T C G G C A T C T G G G A A A T
C T G A T G T G C G G T C C C G G T T G A C T G T G C C T A T T C C A G A A A C
G G G G C G T T C A C G A G C G G C T T A C A C T A A T T A G A G T T G T A A G
G C T G G A C G T T C T C G T G T G C G T A A A C T A T A C C C A T A T T C C T
T C T A G A G C A G G T C G A T A T T A C A T G T T G T A A A G G G G C A G T A
C T G A A C G A T G T A T T T G T C T T A T T C T G C A C T G C A G C G G T T A

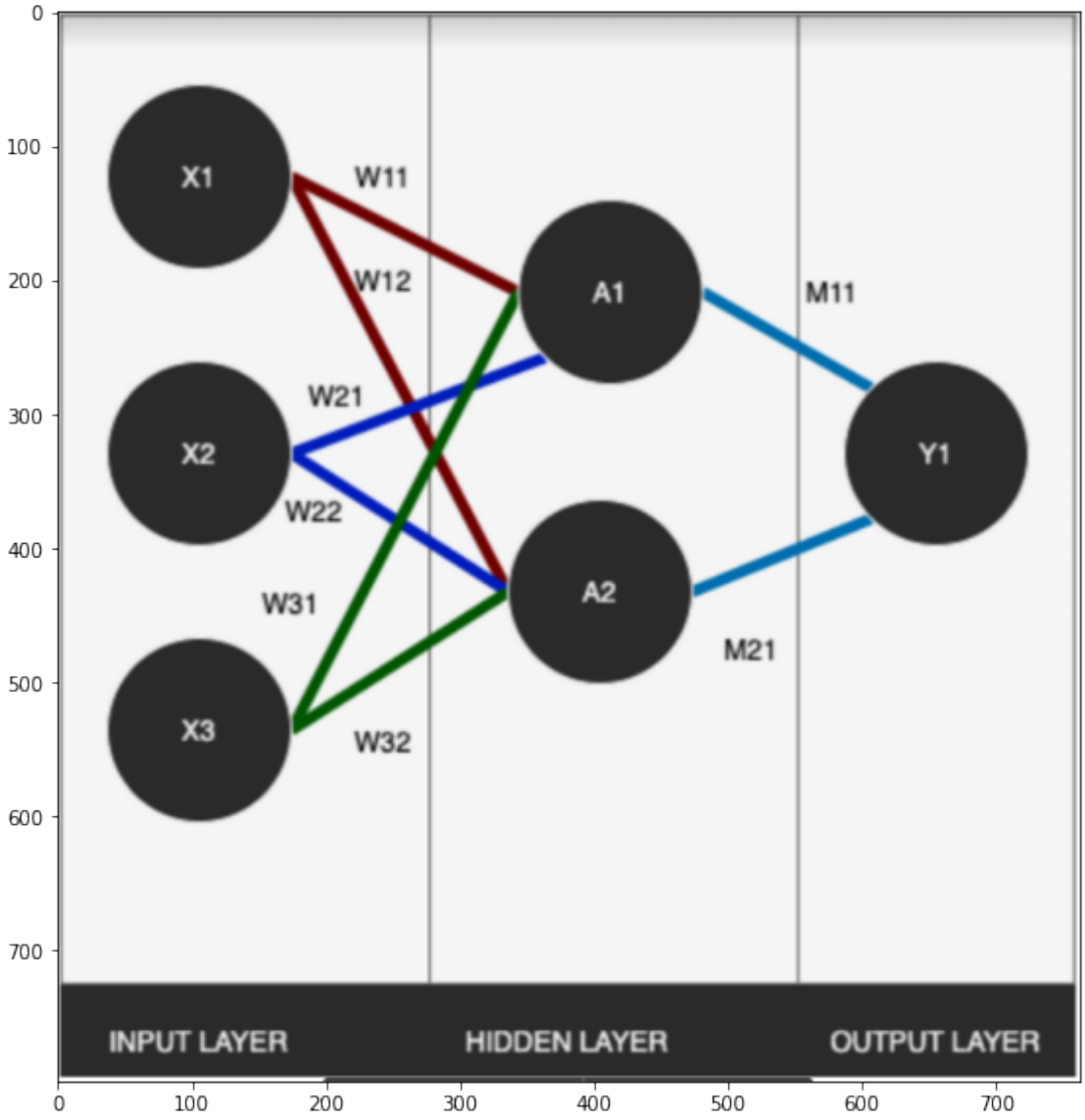
T A T T C T G C A T G A G C T A A C T G G C A T T T T A A A A A G A T T C T T G
G T T T T A T T C T G C A T T C T G C A A G T G A A T T T A T T C T G C A T C C
C G C A A T G G C T A T T C T G C A A T T C T G C A C C T A G C G G T A G C G G
G C A C T C A G C G A G A G G G C G T A T T C T G C A A T T C T G C A G G G T T
A T C A C G A G G G A T G T G A A A T G G C C A C C A T C T A T T C T G C A T C
T G C A A T A T T C T G C A G C C C A T T T A T A T T C T G C A A T A A G G G T
T A T T T A T T C T G C A T T A G G G A C A T T G T G A C C T T C A C T A T T C
T G C A A A C A A G A T T G T A T T C T G C A A C A T T G A C G G G A T T G G G
A C T A T T C T G C A A A A T T T T T C A T G A T A T T C T G C A A G C T C C T
T A C T C T G G T A T T C T G C A G C A G G G A G G G A G T C G T G A C T T A A
A A A A G C T T C T A T T C T G C A T T C T G C A C A A C C A A A T A G C A A T
C T T T A T T C T G C A T G C A A A T A T T C T G C A T T A C C A G T A T T C T
G C A T G C A A T T C T G C A T T A T T C T G C A A T A G G T A G G G T T T T A
A T G T G C A G T C T T T A G T A C C G T T G G C G G C A C T A C C T T C T C T
C A T C G T T G G C T G A T G T A T G T C A T A T G A C A C C C G T C T G A G C
A A A C A T G T G G T T G T G A A G G C G G C G G T A A T A A T T T A T G C T A
A C C A C G A A A T G C G T A G A A C T A C T G G T A C C A A T G A G T G G A G
C C C A C G A C T G G G C G G A C A G A G G A T A C T G C A G C C C C G A G G T G
A T G C C G G G G C A A A G C T G T C T A T C C C C C C T C A A C T G G A G C T
T A C G C C C A A T G A A G C G G A C G G A A A G C T G C T T A G C C A T A C C
G A T C G A A C C T G T T C A T A T C C T A A C C A G A A A G T T C G A C G T G
A C A A A A C G T C G A A G A T C G C T C T A T T C C G A C T T C G G A G G T C
G C T A T A A C A G G T C A A C C T T T T T T C A A C C T T T T T A C C C C C A
A A C C T T T T T T C T T T T G C G G G C C C A A T G T G G C C C C T G T A T T
A A C C T T T T T T T G G T C A A C C T T T T T C G A A T C T T T C G A A C C T T
T T T C A G A A C C C T T G T T A A T A A C C T T T T T T G C T A C C C G C T G A
C T C T C A A C C T T T T T T T T T T A A C C T T T T T T A A C C T T T T T T G C A C
C G A A A C C T T T T T T A C C T T T T T T C T A A C C T T T T T T A A C C T T T T T T
G A A A A C C T T A A C C T T T T T T T T T T C G G T G A C G C C C A C G A A A C C
T T T T T T A T A A A C C T T T T T T T G A T C G T T T C G C C G T A A G A C T C
T C T A A C C T T T T T T G C A C G A T T C G A A G A A A C C T T T T T T C T T A A
C C T T T T T T T T T T T C G C G T G G T G A G T C C T T C T G T A C A G A C C G
T G A A A T C G C A A T T T C A A A C C T T T T T T T G A G G A G G G T G T A A A
C C T T T T T A C C T T T T T C T T A G C C A A T C T C G C C G T G C A C A G T
A T A A C C T T T T T T A T G A G T C G C G C A A T C G T C A A C C T T T T T T T T
A C T A C T G A T A C A A A C C T T C T G T T C C T C T T T C A G A G G C T T G
T T G T A G G T A C T G T T C C T C C T C C G A C C T G T T C C T A A G T C C G
A C A A G T C T G T T C C T C C C T G C T G T T C C T T C C T G A C A A G T C C
G A C C T G T T C T G T T C C T G A C A A C T G T T C C T G T C C T G T T C C T
G C T T T C C G A C A A G T C C C T G T T C C T T C C T G T C C G A C A A G T C
T C C T G C T C C T G C T G T T C C T T C C G A C A A G T C C G A C A A G T C C
T C C T G C T C C T T C C T A C A A G C T G T T C T C C T G C T G T C C G A T C
C T G C T G C T T C T C C T G C T G A C A A G T C C G A C A T C C T G C T C C T
G C T T T C C T A C A A C T G T T C C T C C T C T C C T C C T G C T C C T T C C
T G C T T T C C T C T G T T C C T C T G T T C C T C T G T T C C T T C C T G C T
T C C T G C T T C C T G C T T C C T G C T T C C T G C T T C C T G C T T C C T G
T C T C C T G T C C T G C T G C T T C C T G C T T C C T G C T T C C T G T C C T
G C T T C C T G C T T C C T G C T T C C T G C T G T T A G T A G T T A G T A G T

```
T A G T A G T T A G T A G T T A G T A G T T A G T A G T T A G T A G T T A G T A
G T T A G T A G T T A G T A G T T A G T A G T T A G T A G T T A G T A G T T A G
T A G T T A G T A G T T A G T A G T T A G T A G T T A G T A G T T A G T A G T T
A G T A G T T A G T A G T T A G T A G T T A G T A G T T A G T A G T T A G T A G
T T A G T A G T T A G T A G T T A G T A G T T A G T A G T T A G T A G T T A G T
A G T T A G T A G T T A G T A G T T A G T A G T T A G T A G T T A G T A G T T A
G T A G T T A G T A None
```

6. Neural Network

[19]:
```
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
img = mpimg.imread('../jm2.png')

fig, ax = plt.subplots(figsize=(15, 10))
plt.imshow(img)
plt.show()
```

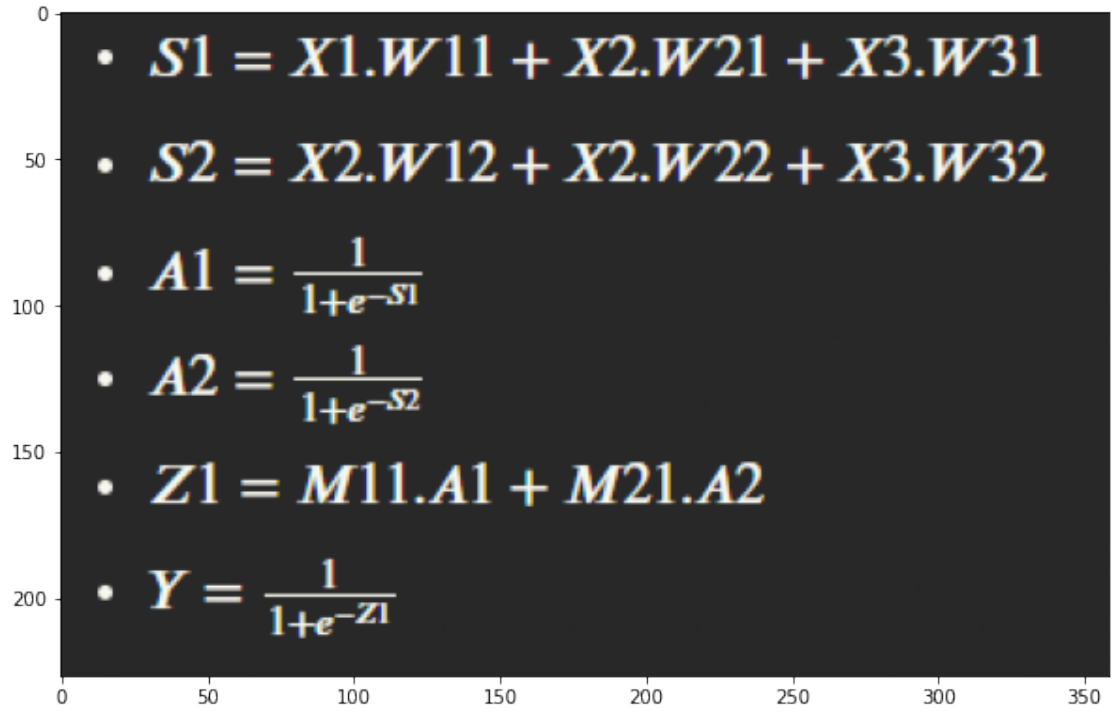


- Terdapat proses yang dinamakan feed-forward. Input dalam sebuah neural network diproses ke hidden layer hingga ke output layer.
- Setiap Node, menunjukan neuron dan setiap garis menunjukan weight.
- Proses Feed-Forward berjalanan dari input layer menuju output layer.
- Nilai yang masuk ke neuron di hidden layer adalah penjumlahan antara perkalian weight dengan
- nilai yang masuk pada input neuron setelah itu diaktifkan dengan fungsi aktivasi. Atau dapat dimodelkan sebagai berikut:

[26]:
```
img = mpimg.imread('4.png')

fig, ax = plt.subplots(figsize=(10, 8))
```

```
plt.imshow(img)
plt.show()
```



[20]:
```
W = [[0.5, 0.4],[0.3, 0.7],[0.25 , 0.9]]
M = [[0.34] , [0.45]]
X = [9, 10, -4]
```

[21]:
```
import math

def WTi(W, i): #Untuk mengambil setiap elemen pada index i dalam list
    return list(map(lambda w: w[i], W))

def WT(W): #Mengaplikasikan func WTi berdasarkan jumlah elemen list dalam list,␣
 ↪sehingga W akan berubah bentuk ke bentuk transposenya
    return list(map(lambda i : WTi(W, i), range(len(W[0]))) )

def XW(X,W):#Mengalikan Wji * Xi dan menjumlahkan semua hasil perkaliannya
    return map( lambda w: r(add, map( lambda xx,ww : xx * ww, X, w), 0), WT(W) )

def A(x): #fungsi aktivasi
    return 1/(1+math.exp(-x))

def hidden_layer(X,W): #Mapping dari input layer ke hidden layer atau dari␣
 ↪hidden layer menuju output layer
```

```
    return list(map(lambda x: A(x), XW(X,W) ))

def feed_forward(X, W, M): #menghitung input layer dan hidden layer dengan␣
 ↪fungsi untuk menghasilkan output layer
    return hidden_layer(hidden_layer(X,W), M)
```

[22]:
```
hidden_layer(X,W)
```

[22]:
```
[0.998498817743263, 0.9990889488055994]
```

[23]:
```
feed_forward(X,W,M)
```

[23]:
```
[0.6876336740661236]
```