

# 情報科学入門練習問題

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時間：約7時間

練習 1.3

```
distance.rb
include(Math)
def distance(x,y,u,v)
  sqrt((x-u)**2+(y-v)**2)
end
```

```
yardpound.rb
def feet-to-cm(f,i)
  f*30.48+i*(30.48/12)
end
```

```
def pound-to-kg(p,o)
  0.4536*p+(0.4536)/16*o
end
```

練習 1.9

```
def celsius-to-fahrenheit(c)
  (9/5)*c+32
end
```

```
def fahrenheit-to-celsius(f)
  (f-32)*(5/9)
end
```

```
def ms-to-mph(v)
  v*(3600/1609.0)
```

end

```
wci.rb
def wind-chill-index(t,v)
  35.74+0.6215*t
  -35.75*(v**(0.16))+0.4275*t*(v**(0.16))
end
```

```
def wind-chill-index-celsius(t,v)
  wind-chill
  -index(celsius-to-fahrenheit(t),ms-to-mph(v))
end
```

```
quadratic.rb
```

```
def det(a,b,c)
  b**2-4*a*c
end
```

```
def solution1(a,b,c)
  (-b+sqrt(det(a,b,c)))/(2*a)
end
```

```
def solution2(a,b,c)
  (-b-sqrt(det(a,b,c)))/(2*a)
end
```

```
def quadratic(a,b,c,x)
```

```

a*x*x+b*x+c
end

def solutions(a,b,c)
  if a==0
    1
  else
    if det(a,b,c)>0
      2
    else
      if det(a,b,c)==0
        1
      else
        0
      end
    end
  end
end
end

```

end

```

def solve1(a,b,c)
  if a==0
    (-c)/b
  else
    if det(a,b,c)>0
      solution1(a,b,c)
    else
      if det(a,b,c)==0
        solution1(a,b,c)
      else
        nothing
      end
    end
  end
end
end
end

```

```

image-average.rb
def sum(a,x)
  a[x-1]+a[x]+a[x+1]
end
練習 2.2
def array-average3(a,x)
  sum(a,x)/3.0
end
練習 3.1
def abs(x)
  if x<0
    -x
  else
    x
  end
end
end

```

練習 3.3

```

median.rb
def median(x,y,z)
  if x<y
    if y<z
      y
    else
      if z<x
        x
      else
        z
      end
    end
  else
    if x<z
      x
    else
      if z<y
        y
      else
        z
      end
    end
  end
end

```

```

        end
      end
    end
  end
end

tax.rb
def income_tax(income)
  if income<=195
    income*0.05
  else
    if income<=330
      (income-195)*0.1
      +195*0.05
    else
      if income<=695
        (income-330)*0.2
        +(330-195)*0.1
        +195*0.05
      else
        if income<=900
          (income-695)*0.23
          +(695-330)*0.2
          +(330-195)*0.1
          +195*0.05
        else
          if income<=1800
            (income-900)*0.33
            +(900-695)*0.23
            +(695-330)*0.2
            +(330-195)*0.1
            +195*0.05
          else
            (income-1800)*0.4
            +(1800-900)*0.33
            +(900-695)*0.23
            +(695-330)*0.2
            +(330-195)*0.1
            +195*0.05
          end
        end
      end
    end
  end
end

```

```

        end
      end
    end
  end
end

calender.rb
#二月の日数を求める
def days_of_february(year)
  if year%400==0
    29
  else
    if year%100==0
      28
    else
      if year%4==0
        29
      else
        28
      end
    end
  end
end

#year 年 month 月の日数を求める
def days_of_month(year,month)
  if month==4 || month==6
    || month==9 || month==11
    30
  else
    if month==2
      days_of_february(year)
    else
      31
    end
  end
end
end

```

### 練習 3.5

```
def divisible(x,y)
  x%y==0
end
```

```
def leap_year(y)
  days_of_february(y)==29
end
```

```
def within_range(a,i)
  i<=a.length()-1
end
```

### 練習 3.6

#論理関数

```
def xor(x,y)
  if x==false && y==false
    false
  else if x==false && y==true
    true
  else if x==true && y==false
    true
  else if x==true && y==true
    false
  end
end
end
end
end
end
```

```
def implies(x,y)
  if x==false && y==false
    true
  else if x==false && y==true
    true
  else if x==true && y==false
    false
  end
end
```

```
else if x==true && y==true
  true
end
end
end
end
end
```

### 練習 3.7

#長い方の文字列を求める

```
def longer(s,t)
  if s.length()<t.length()
    t
  else
    s
  end
end
```

#先頭と最後の文字を取り除いた文字列

```
def trim(s)
  s[1..(s.length()-2)]
end
```

#前半と後半の文字列を入れ替えた

```
def upsidedown(s)
  t=s[0..s.length()/2-1]
  u=s[s.length()/2..s.length()-1]
  s=u+t
end
```

### 練習 3.8

#a の x 番目とその前後の要素数を数える関数

```
def length(a,x)
  if 0<x && a.length()-1>x
    3
  else if x==0 && a.length()==1
    1
  end
end
```



```

end
b)
def power2_loop(n)
  p=2
  for i in 2..n
    p=p*2
  end
  p
end

c)
def power_loop(x,n)
  p=x
  for i in 2..n
    p=p*x
  end
  p
end

d)
def taylor_e_loop(x,n)
  t=0
  for k in 0..n
    t=t+(power_loop(x,k)
          /factorial_loop(k))
  end
  t
end

```

#### 練習 4.7

```

a)
#約数の個数
def nod_loop(k,n)
  if n>=2
    if divisible(k,n)
      nod_loop(k,n-1)+1
    else
      nod_loop(k,n-1)
    end
  end
end

```

```

end
else
  1
end
end
b)
#素数の個数
def nop_loop(n)
  if n>=2
    if prime2(n)
      nop_loop(n-1)+1
    else
      nop_loop(n-1)
    end
  else
    0
  end
end

c)
#約数の和の最大
def msod_loop(n)
  max=0
  i=1
  while i<=n
    if max<sod(i,i)
      max=sod(i,i)
    end
    i=i+1
  end
  max
end

```

#### 練習 4.8

```

a)
#a より大きくかつ最小の素数
def np_loop(n)
  n=n+1
  while !prime2(n)
  end
end

```

```

        n=n+1
    end
    n
end

```

b)  
 #素数 p よりも大きな素数の列を考え、先頭から  
 n 番目の数

```

def nth_prime_loop(p,n)

```

```

    p=p+1
    i=0
    while i<n
        if prime2(p)
            i=i+1
        end
        p=p+1
    end
    p-1
end

```

```

def perfect_loop(n)
    sod(n,n)-n==n
end

```

練習 4.9

```

a)
#再帰的に n の階乗
def factorial(n)
    if n>=2
        factorial(n-1)*n
    else
        1
    end
end

```

end

b)  
 #2 の n 乗を求める

```

def power2(n)
    if n>=1
        2*power2(n-1)
    else
        1
    end
end

```

end

c)  
 #x の n 乗を求める

```

def power(x,n)
    if n>=1
        x*power(x,n-1)
    else
        1
    end
end

```

練習 4.10

```

a)
#約数の個数
def nod(k,n)
    if n>=2
        if divisible(k,n)
            nod(k,n-1)+1
        else
            nod(k,n-1)
        end
    else
        1
    end
end

```

b)  
 #素数の個数

```

def nop(n)
    if n>=2
        if prime2(n)

```

```

        nop(n-1)+1
    else
        nop(n-1)
    end
else
    0
end
end
end

```

c)

#約数の和の最大

```

def msod(n)
    if msod(n-1)>=sod(n,n)
        msod(n-1)
    else
        if msod(n-1)<sod(n,n)
            sod(n,n)
        else
            sod(1,1)
        end
    end
end
end

```

練習 5.3

```

def fiba(k)
    ((1+sqrt(5))/2)**(k+1)/(sqrt(5))
end

```

練習 5.7

a)

```

def matmul(a,b)
    c=make2d(2,2)
    c[0][0]=a[0][0]*b[0][0]
        +a[0][1]*b[1][0]
    c[0][1]=a[0][0]*b[0][1]
        +a[0][1]*b[1][1]
    c[1][0]=a[1][0]*b[0][0]
        +a[1][1]*b[1][0]

```

```

    c[1][1]=a[1][0]*b[0][1]
        +a[1][1]*b[1][1]

```

```

    c
end

```

b)

```

def matsquare(a)
    matmul(a,a)
end

```

c)

```

def matpower(a,n)
    c=make2d(2,2)
    if n==0
        [[1,0],[0,1]]
    else
        if n>=2
            if is_even(n)
                matsquare(matpower(a,n/2))
            else
                matmul(a,matpower(a,n-1))
            end
        end
    end
end
end

```

練習 5.10

```

def min_index(a,i)
    k=i
    for j in (i+1)..(a.length()-1)
        if a[j]<a[k]
            k=j
        end
    end
    k
end

```

練習 5.11

```

def merge(a,b)
  c=make1d(a.length()
           +b.length())
  ia=0
  ib=0
  ic=0
  while ia<a.length()
    && ib<b.length()
    if a[ia]<b[ib]
      c[ic]=a[ia]
      ia=ia+1
      ic=ic+1
    else
      c[ic]=b[ib]
      ib=ib+1
      ic=ic+1
    end
  end
  end

  if ia>=a.length()
    for k in ib..(b.length()-1)
      c[ic]=b[k]
    end
  else
    for k in ia..(a.length()-1)
      c[ic]=a[k]
    end
  end
end

c
end

練習 5.18
#ビン整列
a)
def count(a,max)
  c=make1d(max)
  for i in 0..max-1
    c[i]=0
  end
  for j in 0..(max-1)
    for i in 0..(a.length()-1)
      if a[i]==j
        c[j]=c[j]+1
      end
    end
  end
  c
end

b)
def rebuild(c,n)
  r=make1d(n)
  s=0
  for j in 0..(c.length()-1)
    for i in 0..(n-1)
      if c[j]==i
        r[s..(s+i-1)]=j
        s=s+i
      end
    end
  end
  r
end

c)
def binsort(a,max)
  b=make1d(max)
  b=count(a,max)
  sum=0
  for i in 0..(max-1)
    sum=sum+b[i]
  end
end

```

```

    rebuild(b,sum)
end

```

#### 練習 6.2

#関数の f(x) の積分

```

def simpson(xs,xe,n)
    deltax=(xe-xs)/(2.0*n)
    sum=f(xs)+4*f(xs+deltax)+f(xe)
    for i in 1..(n-1)
        sum=sum+(2*f(xs+2*i*deltax)
            +4*f(xs+(2*i+1)*deltax))
    end
    (1/3.0)*deltax*sum
end

```

#### 練習 6.14

a)

#関数 g(x) の積分

```

def trapezoid_sinlog(xs,xe,n)
    deltax=(xe-xs)*1.0/n
    sum=(g(xs)+g(xe))/2.0
    for i in 1..(n-1)
        sum=sum+g(xs+i*deltax)
    end
    deltax*sum
end

```

b)

#関数 g(x) の積分

```

def simpson_sinlog(xs,xe,n)
    deltax=(xe-xs)/(2.0*n)
    sum=g(xs)+4*g(xs+deltax)+g(xe)
    for i in 1..(n-1)
        sum=sum+(2*g(xs+2*i*deltax)
            +4*g(xs+(2*i+1)*deltax))
    end
    (1/3.0)*deltax*sum
end

```

#### 練習 6.15

```

def montecarlo3d(n)
    m=0
    for i in 1..n
        x=rand()
        y=rand()
        z=rand()
        if x*x+y*y+z*z<1.0
            m=m+1
        end
    end
    m*8.0/n
end

```

#### 練習 7.1

```

G A C G
G C A G

```

```

A G C G - A
A - C G T A
x      x

```

#### 練習 7.4

```

def align(s,t)
    m=s.length()
    n=t.length()
    a=make2d(m+1,n+1)
    a[0][0]=0
    for j in 1..n
        a[0][j]=a[0][j-1]+g()
    end
    for i in 1..m
        a[i][0]=a[i-1][0]+g()
    end
end

```

```

for i in 1..m
  for j in 1..n
    #a[i][j] を計算する
    a[i][j]=max(a[i,j-1]+g(),a[i-1,j-1] 練習 8.1
                +q(s[i-1],t[j-1]),a[i-1,j]+g())
  end
end
a
end

練習 7.5
def traceback(a,s,t)
  u=""
  v=""
  i=s.length()
  j=t.length()
  while i>0 || j>0
    if j>0
      && a[i][j]==a[i][j-1]+g()
      u="-"+u
      v=t[j-1..j-1]+v
      j=j-1#go left
    else
      if i>0 && j>0
        && a[i][j]==a[i-1][j-1]
          +q(s[i-1],t[j-1])
        #左上から求められた場合
        u=s[i-1]
        v=t[j-1]
      else
        if i>0 && a[i][j]==a[i-1][j]+g() b)
          #上から求められた場合
          u=s[i-1]
          v="-"
        end
      end
    end
  end
end

[u,v]
end

a=make2d(400,400)
p=make_points([0,170,90,110,
               150,100,110,170,
               120,360,200,300,
               250,250,360,200,
               300,150,325,175,
               350,200])

for i in 0..(p.length()-1)/2-1
  bezier_draw(p[i*2],p[i*2+1],
              p[i*2+2],a)
end
show(a)
end

練習 8.4
a)
def rotate(p,theta)
  a=Point.new()
  a.x=p.x*cos(theta)-p.y*sin(theta)
  a.y=p.x*sin(theta)+p.y*cos(theta)
  a
end

def circle_draw(p,r,a)
  n=10
  prev=Point.new(p.x+r,p.y)
  for i in 1..n
    t=i*1.0/n
    q=rotate(p,2*3.14/n)
    line_draw(prev,q,a)
  end
end

```

```

    prev=q
  end
end

```

### 練習 8.5

a)

```

def sub(q)
  Point.new(self.x-q.x,self.y-q.y)
end

```

b)

```

def draw(a)
  if 0<=self.y+0.5
    && self.y+0.5<a.length()
    &&0<=self.x+0.5
    && self.x+0.5<a[0].length()
    a=[self.y+0.5][self.y+0.5]=1
  end
end

```

end

c)

```

def interpolate(q,t)
  p.scale(1-t).add(q.scale(t))
end

```

d)

```

def rotate(theta)
  Point.new(self.x*cos(theta)
            -self.y*sin(theta)
            ,self.x*sin(theta)
            +self.y*cos(theta)
  )
end

```

end

### 練習 9.2

a)kato

b)arima,ikedam,masuda,yamada

c)kato

d)arima,ikedam

### 練習 9.4

```

def first_contact(p)

```

```

  if p==nil
    p
  else
    first_contact(p.left)
  end
end

```

### 練習 9.5

```

def request_length(r)
  if r==0
    0
  else
    1+request_length(r.next)
  end
end

```

### 練習 9.6

```

def delete_request(r,t)
  while r.title!=nil
    if r.title==t
      r.next
    else
      r.next=delete_request(r.next,t)
    end
  end
end

```

### 練習 9.7

```

def add_alphabetically(r,s)
  if r==nil
    s
  else
    while s.title>r.title
      r.next=add_alphabetically(r.next,s)
    end
  end
end

```

```
end
```

### 練習 9.9

```
class Karaoke<Request
  attr_accessor("title","next")

  def initialize(t)
    super(t)
  end

  def add(s)
    add_request(k,s)
  end

  def add_top(s)
    k.next=s
  end

  def play_next()
    k=k.next
  end

  def cancel(s)
    delete_request(k,t)
  end
end
```