Exercice 1 *3 points*

1.

```
def puissance(x, n):
    if n == 0:
        return 1
    else:
        return x * puissance(x, n-1)
```

2.

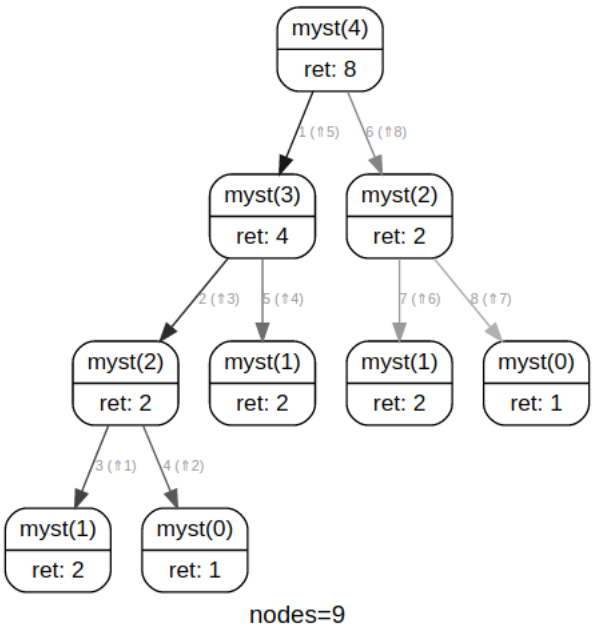
```
def puissance(x,n):
    if n == 0 :
        return 1
    else :
        if n % 2 == 0:
            return puissance(x*x,n//2)
        else :
            return x*puissance(x*x,(n-1)//2)
```

Exercice 2 *3 points*

```
def recherche(lst,m):
    if len(lst) == 1 :
        if lst[0] == m :
            return True
        else :
            return False
    else:
        mid = len(lst)//2
        if lst[mid] > m :
            return recherche(lst[:mid],m)
        else :
            return recherche(lst[mid:],m)
```

Exercice 3 *3 points*

1. `myst(n)=myst(n - 1) × myst(n - 2)`
2.



Exercice 4 *3 points*

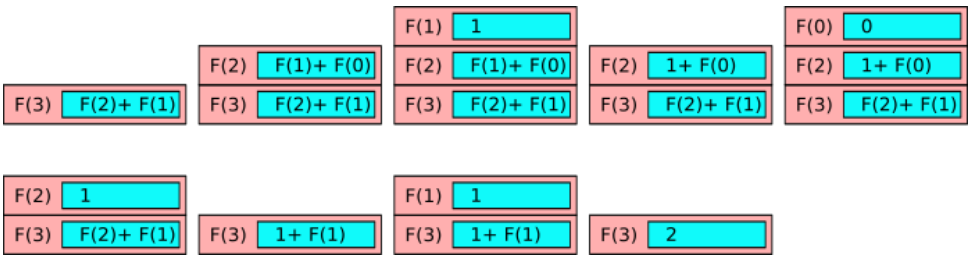
```python
def pgcd(a,b):
    if b == 0 :
        return a
    else :
        return pgcd(b, a % b)
```

Exercice 5 *4 points*

1.

```python
def fibo(n):
    if n == 0 :
        return 0
    elif n == 1 :
        return 1
    else :
        return fibo(n-1) + fibo(n-2)
```

2.



Exercice 6 *4 points*

1. **a.** $Ack(0,1) = 1+1 = 2$
   b. $Ack(0,2) = 2+1 = 3$
   c. $Ack(1,0) = Ack(0,1) = 2$
   d. $Ack(2,0) = Ack(1,1) = Ack(0, Ack(1,0)) = Ack(0,2) = 3$
   e. $Ack(1,2) = Ack(0, Ack(1,1)) = Ack(0,3) = 4$
2.

```python
def ack(m, n):
    if m == 0 :
        return n + 1
    if m > 0 and n == 0 :
        return ack(m-1, 1)
    if  m > 0  and n > 0 :
        return ack(m-1, ack(m, n-1))
```