Algorithm Design & Problem Solving: Some new concepts

Contents

Factorial

$$n! = [1*2*3*4* \ldots *n]$$

n! is "n factorial"

❖**Calculate the following:**

- **6!**
- **4!**
- **3!**

Factorial

❖ **Write an algorithm to calculate n!**

Factorial (n)	*-----function name*
fact=1	*-----variable initialisation*
for i=1 to n	*------loop declaration*
fact=fact*i	*-----factorial equation*
return fact	*-----send value from function*

Factorial

❖ **Let's test it with 4! (4*3*2*1=24)**

Factorial (n)
   fact=1
   for i=1 to n
      fact=fact*i
   return fact

Factorial n = 4			
i=1	i=2	i=3	i=4
fact=1*1	fact=1*2	fact=2*3	fact=6*4
fact=1	fact=2	fact=6	fact=24
1	**2**	**3**	**4**

❖**Let's test it with 0! (=1)**

Factorial (n)

　fact=1

　for i=1 to n

　　　fact=fact*i;

　return fact

Factorial n =0
i=1
fact=1*?
fact=?

1

**PROBLEM!
How can we fix it?**

Factorial

❖**An altered algorithm ….**

Factorial (n)
   fact=1
   if n=1 or n=0
      return 1
   else
   for i=1 to n
      fact=fact*i;
  return fact

❖**Calculate the following:**

- 2 ^ 4
- 3 ^ 3
- 4 ^ 2

❖**Write an algorithm to calculate X ^Y:**

Power (x, y)   *------function name*

     ans=1   *------variable initialisation*

     if y=1   *------if condition*

         return 1   *------send value from function*

    else

         for i=1 to y   *------loop declaration*

            ans=ans * x; *------power equation*

        return ans   *------send value from function*

❖**Let's test it with 2 ^ 3 (2 * 2 * 2 = 8):**

Power (x, y)

ans=1

if y=1

   return 1

else

   for i=1 to y

      ans=ans * x;

   return ans

2^3		
x=2, y=3		
ans = 2	ans = 4	ans = 8

1   **2**   **3**

❖ **Let's test it with 2 ^ 1 (= 2):**

Power (x, y)

ans=1

if y=1

  return 1

else

  for i=1 to y

    ans=ans * x;

  return ans

2^1
x=2, y=1
ans = 1

1
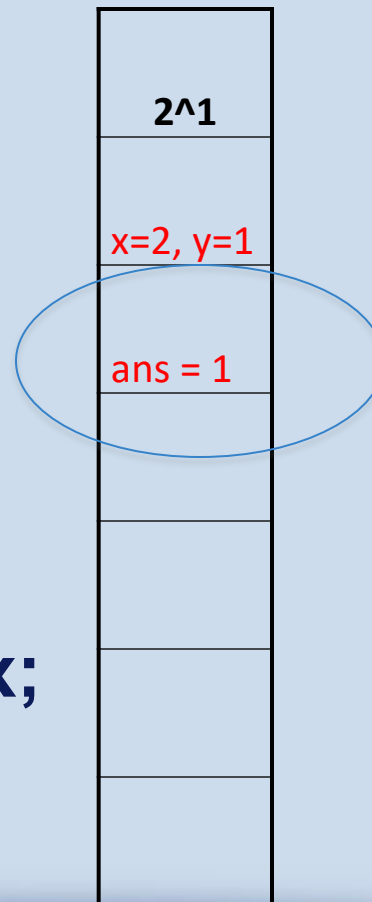
PROBLEM!
How can we fix it?

❖**An altered algorithm:**

Power (x, y)

ans=1

if y=0

2 ^ 1 will now be catered for in the for loop

return 1

else

for i=1 to y

ans=ans * x;

return ans