



Análisis de Algoritmos

Ejercicio 08: "Análisis de algoritmos recursivos"

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Ejercicio 08: Análisis de algoritmos recursivos

Análisis de Algoritmos

1. Ejercicio 01:

```
1  int coef(int n,int k)
2  {
3      if (k==0||k==n)
4          return 1;
5      else if (k>0&& k<n)
6          return coef(n-1,k-1)+coef(n-1,k);
7  }
```

Figura 1: Código 01

Contando: Aritmeticas, comparaciones, asignaciones y recurrencias

$$T(n)=10+2T(n-1)$$

$$T(0)=3$$

$$T(1)=6$$

$$T(n)-2T(n-1)=10$$

$$b=1$$

$$p(n)=10$$

$$d=0$$

$$k=1$$

Sustituyendo...

$$(x^1 - 2x^0)(x - 1) = 0$$

$$(x-2)(x-1)=0$$

Raices:

$$r1=2$$

$$r2=1$$

$$T(n) = C_1 2^n + C_2 1^n$$

$$T(n) = C_1 2^n + C_2$$

De condiciones iniciales:

$$T(0)=C1+C2=1$$

$$T(1) = 3+2T(0)= 3+2=5$$

$$T(1)=2C1+C2=5$$

Resolvemos:

$$-(C1+C2=1)$$

$$2C1+C2=5$$

$$C1=4$$

Sustituyendo:

$$2C1+C2=5$$

$$2(4)+C2=5$$

$$8-5= -C$$

$$C=3$$

$$T(n) = 4(2^n) - 3 - - - - - \epsilon O(2^n)$$

2. Ejercicio 02:

```
1 Busqueda(A[],i,val)
2 {
3     if(i<0)
4         return -1
5     if(A[i]==val)
6         return i
7     return Busqueda(A[],i-1,val)
8 }
```

Figura 2: Código 02

Análisis:

$$T(n)=3+T(n-1)$$

$$T(0)=1$$

$$T(1)=2$$

$$T(n)-T(n-1)=3$$

$$b=1$$

$$p(n)=3$$

$$d=0$$

$$k=1$$

Sustituyendo...

$$(x^1 - x^0)(x - 1)^{0+1} = 0$$

$$(x-1)(x-1)=0$$

Raices

$$r1=1$$

$$r2=1$$

$$T(n) = C_1 n^0 1^n = C_1 + C_2 n$$

$$T(0)=C_1+C_2(0)= C_1 = 1$$

$$T(1)= C_1+C_2(1) = C_1+C_2 = 2$$

$$C_1+C_2=2$$

$$C_2=2-C_1$$

$$C_2=2-1$$

$$C_2=1$$

$$C_1=1$$

$$T(n) = 1 + n - - - - - \epsilon O(n)$$

3. Ejercicio 03:

```
1  Palindromo(cadena)
2  {
3      if(longitud(cadena)==1)
4          return TRUE
5      if(primer_caracter(cadena)!=ultimo_caracter(cadena))
6          return FALSE
7
8      cadena=remover_primer_ultimo_caracter(cadena)
9      Palindromo(cadena)
10 }
```

Figura 3: Código 03

Análisis:

$$T(n)=3+T(n-1)$$

$$T(0)=1$$

$$T(1)=2$$

$$T(n)-T(n-1)=3$$

$$b=1$$

$$p(n)=3$$

$$d=0$$

$$k=1$$

$$(x^1 - x^0)(x - 1)^1 = 0$$

$$(x-1)(x-1)=0$$

Raices:

$$T(n)= C1+C2n$$

$$T(0) \ C1= 1$$

$$T(1)= C1+C2= 2$$

$$C1=1$$

$$C2=1$$

$$T(n) = 1 + n - - - - - \epsilon O(n)$$

4. Ejercicio 04:

```
1  SubAlgoritmo Volados(n,cadena)
2      Si n!=0
3          Volados(n-1,concatenar(cadena,'S'))
4          Volados(n-1,concatenar(cadena,'A'))
5      SiNo
6          Mostrar cadena
7      FinSi
8  FinSubAlgoritmo
```

Figura 4: Código 04

Análisis:

$$T(n)=3+2T(n-1)$$

$$T(0)=1$$

$$T(n)-2T(n-1)=3$$

$$b=1$$

$$p(n)=3$$

$$d=0$$

$$k=1$$

$$(x^{-1} - 2x^0)(x - 1)^1 = 0$$

$$(x-2)(x-1)=0$$

Raices:

$$r1=2$$

$$r2=1$$

$$T(n) = C_1 2^n + C_2 1^n = C_1 2^n + C_2$$

$$T(0) = C_1 2^0 + C_2 = C_1 + C_2 = 1$$

$$T(1) = 3 + 2T(0) = 2 + 3 = 5$$

$$C_1 + C_2 = 1$$

$$2C_1 + C_2 = 5$$

$$C_1 = 4$$

$$C_2 = -3$$

$$T(n) = 4(2^n) - 3 - - - - - \epsilon O(2^n)$$

5. Ejercicio 05:

```
1  DecABin(n)
2  {
3      if(n>1)
4          DecABin(n/2)
5          Mostrar(n%2)
6  }
```

Figura 5: Código 05

TOMANDO EN CUENTA EL TEOREMA MAESTRO

Análisis:

$$T(n) = T\left(\frac{n}{2}\right) + 2$$

$$T(0)=2$$

$$f(n) = 2 - - - - - \epsilon O(1)$$

CASO 2

$$n^{\log_2^1} = 1$$

$$T(n) = \Theta(n^{\log_2^1} \log(n))$$

$$T(n) = \Theta(\log(n))$$

6. Ejercicio 06:

```
1  int Producto( int a, int b)
2  {
3
4      if (b==0)
5          return 0;
6      else
7          return a + Producto(a,b-1);
8  }
```

Figura 6: Código 06

Análisis:

$$T(n)=3+T(n-1)$$

$$T(0)=1$$

$$T(n)-T(n-1)=3$$

$$b=1$$

$$p(n)=3$$

$$d=0$$

$$k=1$$

$$(x-1)(x-1)=0$$

Raices:

$$r1=1$$

$$r2=1$$

$$T(n) = C_1 n^0 1^n + C_2 n^1 1^n = C_1 + C_2 n$$

$$T(0)=C1+C2(0)=C1=1$$

$$T(1)=3+T(0)=3+1=4$$

$$T(1)=C1+C2(1)= C1+C2=4$$

$$C1= 1$$

$$C2= 3$$

$$T(n) = 1 + 3n - - - - - \epsilon O(n)$$