Study set I

Exercise 2.1-2

**for** j =2 **to** A.*length*

*key=*  A[j]

i = j - 1

**while** i > 0 and *=*  A[j]< *key*

A[i+1]= A[i]

i =i -1

A[i+1]=*key*

Exercise 2.1-3

**for** j =1 **to** A.*length*

if A[j]=V

return j

return NIL

**Initialization:** Initially the subarray is empty. So, none of its’ elements are equal to vv.

**Maintenance:**  we check whether A[j] is equal to v or not. If yes, we terminate the loop or we continue the iteration.

**Termination:** if we found the value V or we don’t find it

Exercise 2.1-4

Add-binary(A,B,C)

Carry=0

For i=1to A.length

C[i]=(A[i]+B[i]+carry)%2

Carry=(A[i]+B[i]+carry)/2

C[i]=carry

***2.2-1***

***N3/10000< N3/1000-100 N2-100N+3<4N3***

***Therefor it is equal to theta(N3)***

2.2-2

n=A.length

for i= 1 to n-1

k=i

min=A[i]

for j=i+1 to n

ifA[j]<min

min=A[j]

K=j

SWAP(A[I],A[K])

(1)two loops invariants are maintained the outer loop form 1…n-1 and the nested loop from 2…n

(2)if the first n-1 elements are in the right position

*then the nth element is in the right position*

*(3 ) the best case and worst case are the same T(n)=(n-1)+(n-2)+(n-3)+….1=n(n-1)/2=theta(n2)*

*2.3-2*

*MERGE(A, p, q, r)*

*n1 = q - p + 1*

*n2 = r - q*

*for i = 1 to n1*

*L[i] = A[p + i - 1]*

*for j = 1 to n2*

*R[j] = A[q + j]*

*i = 1*

*j = 1*

*for k = p to r*

*if i<=n1 and(j>n2 or l[i]<=R[j])*

*A[k]=L[i]*

*i=i+1*

*else*

*A[k]=R[j]*

*J=j+1*

*2.3-5*

*BINARY-SEARCH(A, v, P, R)*

*while P ≤ R*

*mid =(P + R) / 2*

*if v == A[mid]*

*return mid*

*else if v > A[mid]*

*P = mid + 1*

*else R = mid - 1*

*return NIL*

*T(n)= theta(1) n=1*

*Theta(n/2)+theta(1) when n>1*

*So T(n)=theta(lgn)*

3.1-2

Because a could be negative number

Therefore n+|a|>= n+a>=n-|a|

Lower-bound

n+|a|>= n+a>=n-|a|

n+|a|>=n-|a|>=c1n

n>=|a|/(1-c1)

let c1=1/2

so n+a>=n-|a|>=n/2

n+a>=n/2

n>=2|a|….. equation 1

upper bound

c2n>=n+|a|>=n+a

c2n>=n+|a|

n>=|a|/(c2-1)…… equation 2

according to equation 1 and 2

|a|/( c2-1)=2|a|

1/ (c2-1)=2

½=(c2-1)

c2=3/2

therefore

3/2n>=n+a>=n/2

(3/2)b>=(n+a)b>=(1/2)bnb

3.1-4

2(n+1)<=C.2n =>C=2 so when C=2 2(n+1)= O(2n)

If 2(2n) <=C.2n  then C>= 2n so C is not a constant so the answer is no

3.2-5

N!=sqrt(2piN)(n/e)n

Lg(N!)=lg(sqrt(2piN))+lg((n/e)n)+lg(1+theta(1/n))

1+theta(1/n)=O(n)

So lg(n!) =1/2 lg(2pi)+1/2lg(n)+nlgn-nlge+O(lg n)=> theta(nlgn)

A close up of text on a white background

Description automatically generated

A close up of a piece of paper

Description automatically generated