

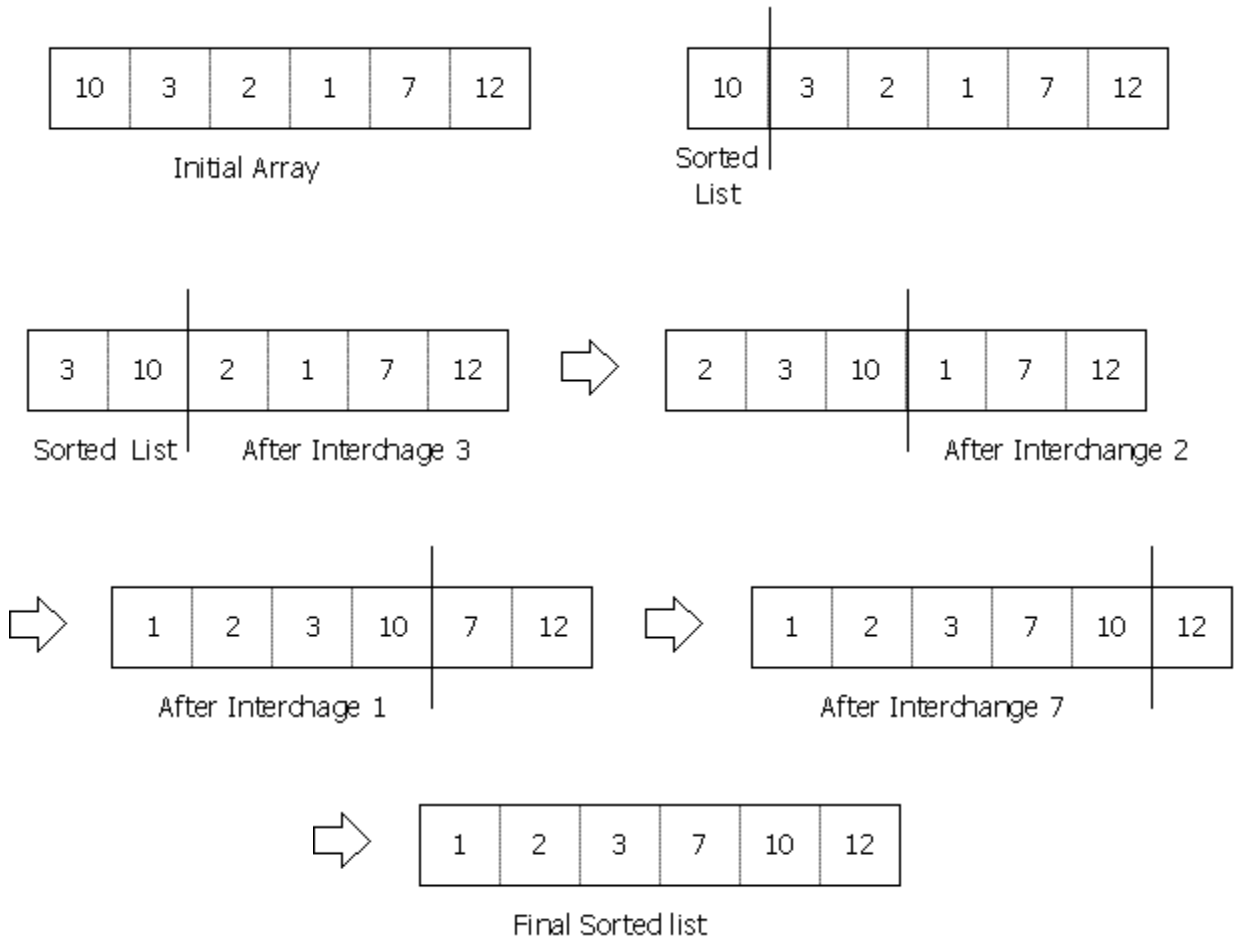
Chapter 9

9.1 Using Insertion sort, sort the following set of numbers:

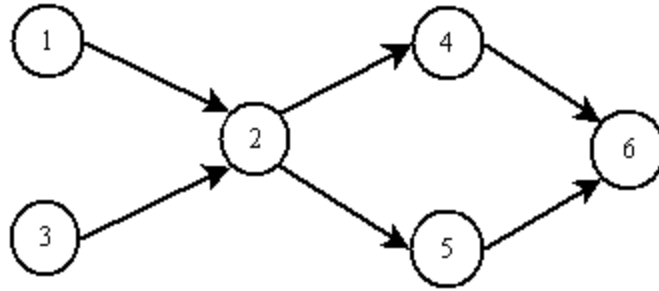
10, 3, 2, 1, 7, 12

Illustrate the intermediate steps.

Solution:



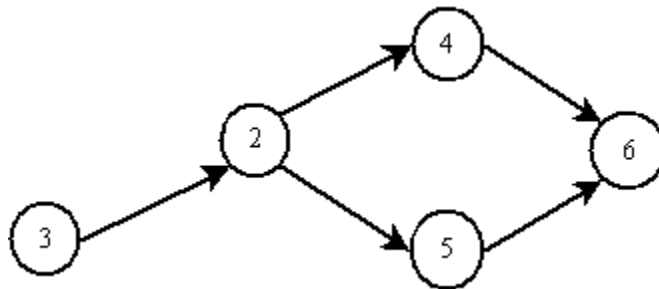
9.2 Using Topological Sort, arrange the vertices of the following graphs:



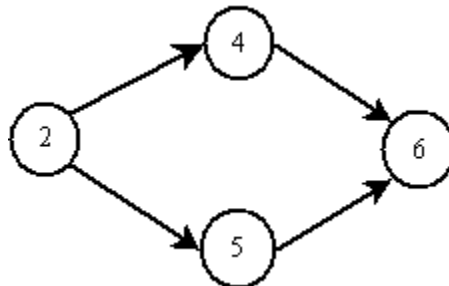
Solution:

a)

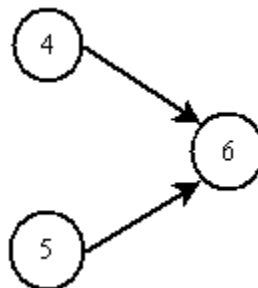
Delete node ①



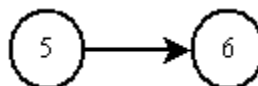
Delete node ③



Delete node ②



Delete node ④

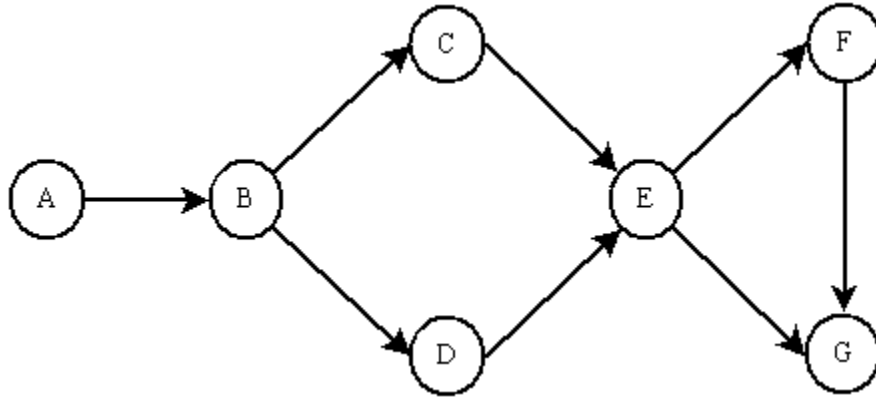


Delete node ⑤

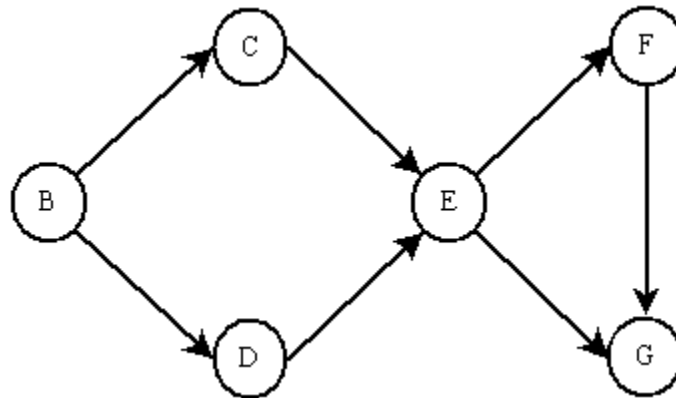
6

∴ The topological order is : 1, 3, 2, 4, 5, 6

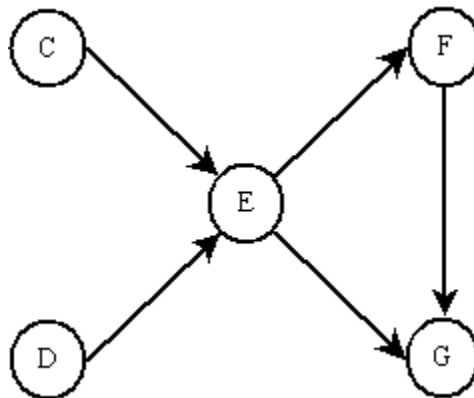
b)



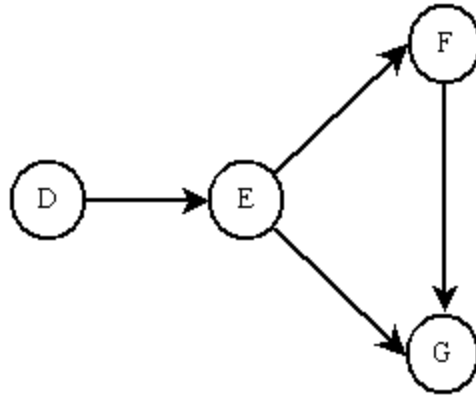
Delete node A



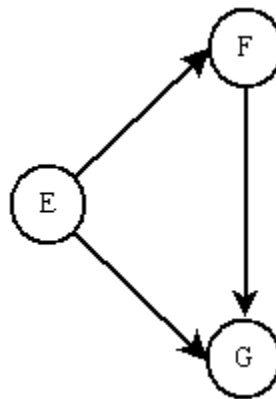
Delete node B



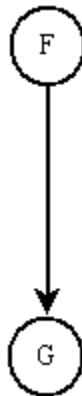
Delete node C



Delete node D



Delete node E



Delete node F



Delete node G

∴ The final Topological order is

A, B, C, D, E, F, G.

9.3 Apply the Johnson-Trotter algorithm for performing permutations for the following objects:

a) 1, 2, 3, 4

The intermediate steps are given as

<1 <2 <3 <4

<1 <2 <4 <3

<1 <4 <2 <3

<4 <1 <2 ,3

4> <1 <2 <3

<1 4. <3 <2

<1 <3 4> <2

<1 <3 <2 4>

<3 <1 <2 <4

<3 <1 <4 <2

<3 <4 <1 <2

<4 <3 <1 <2

4> 3> <2 <1

3> 4> <2 <1

3> <2 4> <1

3 << 2 <1 <4

<2 3> <1 <4

<2 3> <4 <1

<2 <4 3> <1

<4 <2 3> <1

4 > <2 <1 3>

<2 4> <1 3.

<2 <1 4> 3>

<2 <1 3> 4>

b) A D M

< A < D < M

< A < M < D

M>< D < A

< D M >< A

< D < A > M

∴ The possible permutations are

A D M

A M D

M A D

M D A

D M A

D A M

9.4 Consider four elements A, B, C and D. Find the permutation of the sequence.

Solution:

The possible partitions are given below:

abcd abdc acbd acdb adbc adcb bacd badc bcad bcda bdac bdca cabd cadb cbad cbda cdab
cdba dabc dacb dbac dbca dcab dcba

9.5 Consider a set $S = \{1, 2, 3, 6\}$. Find power set of S .

0 0 0 0	{}
0 0 0 1	{6}
0 0 1 0	{3}
0 0 1 1	{3,6}
0 1 0 0	{2}
0 1 0 1	{2,6}
0 1 1 0	{2,3}
0 1 1 1	{2,3,6}
1 0 0 0	{1}
1 0 0 1	{1,6}
1 0 1 0	{1,3}
1 0 1 1	{1,3,6}
1 1 0 0	{1,2}
1 1 0 1	{1,2,6}
1 1 1 0	{1,2,3}
1 1 1 1	{1,2,3,6}

9.6 Simulate a fake coin problem for 12 coins

Solution:

Partition the coins to three sets as (1,2,3,4) (5,6,7,8) and (A,B,C,D)

1. If (1,2,3,4) is equal to (5,6,7,8), then defective is ABCD
2. If (1,2,3,4) < (5,6,7,8) then the first group is having less weight
3. If (1,2,3,4) > (5,6,7,8), then the first group is having more weight

Then proceed to the appropriate group. In three weighting, one can find the group.

9.7 Compute the following multiplications using the Russian Peasant method:

a) 87×14

Solution

$$\begin{array}{rcl} 87 & 14 & 14 \\ 43 & 28 & +28 \\ 21 & 56 & +56 \\ 10 & 112 & \\ 5 & 224 & +224 \end{array}$$

$$1 \quad 448$$

$$1 \quad 896 \quad +896$$

$$\text{Therefore, } 14 + 28 + 56 + 224 + 896 = 1218.$$

b) 127×64

Solution

$$\begin{array}{rcl} 127 & 64 & 64 \\ 63 & 128 & +128 \\ 31 & 256 & +256 \\ 15 & 512 & +512 \\ 7 & 1024 & +1024 \\ 3 & 2048 & +2048 \\ 1 & 4096 & +4096 \end{array}$$

Therefore, the total is 8128.

6 Apply binary search for the following instances of an array (key is 14) and illustrate the intermediate results.

a) $\underbrace{11 \quad 13 \quad 14 \quad 16}_{\text{array}} \mid 17 \quad 19 \quad 22 \quad \textcircled{\frac{(1+7)}{2}} = 4$

$$A(4) = 16$$

$$14 < 16$$

$\therefore$ Search lower array

$$\underbrace{14 \ 16}_{16} \textcircled{2} \text{ Find mid } \frac{(1+4)}{2} = 2$$

$$A(2) = 13$$

$$14 > 13$$

So Search upper part of A

$$\textcircled{14} \textcircled{3} \text{ Find mid } \frac{(1+2)}{2} = 1$$

$$A(1) = 14$$

Since key = A(1) return success.

b) 11 15 20 27 30 35 40 45

$$\text{i) mid} = \left\lfloor \frac{1+8}{2} \right\rfloor = 4, A[\text{mid}] = 27$$

key = 14 < 27, search lower half { 11, 15, 20, 27 }

$$\text{ii) mid} = \left\lfloor \frac{1+4}{2} \right\rfloor = 2, A[\text{mid}] = 15$$

key = 14 < 15, search lower half { 11, 15 }

$$\text{iii) mid} = \left\lfloor \frac{1+2}{2} \right\rfloor = 1, A[\text{mid}] = 11$$

key 11 ≠ 15, return that the item is not present.

7 Select the items specified by location 3 and 7 using selection method.

14 16 17 18 21 23 27 31

Since the array is sorted.

A(3) = 17 and it can be sent as result.

A(7) = 27 and sent as result.

8 Find the median of the following array using selection method

a) 11, 14, 16, 17, 18, 19, 21, 23, 27
 {11, 14, 16, 17, 18} {19, 21, 23, 27}

Median {16, 27}

$$= 16.$$

∴ the median of median is 16.

Looking for location 5

$$|A_{less}| = |2|, \quad |A_{equal}| = 1$$

$$|A_{greater}| = 6, \quad k = 5$$

$$K = 5, \quad 9 - 2 - 1 = 6$$

$\therefore$ split the $|A_{greater}|$ list again and look for 1

{ 17, 18, 19, 21, 23, 27 }

{ 17 } { 18 } { 19, 21, 23, 27 }

Recur for ① to get 18 as median.

b) Find the median of median of the following array

{ 11, 14, 16, 17 } { 18, 21, 27 }

{ 14, 21 }

{ 14 } is median of median.