

# CISC 3220 Homework Chapter 8

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## Exercise 8.1

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### Question 8.1-1

What is the smallest possible depth of a leaf in a decision tree for comparison?

In a best case scenario, each element is compared only once with another element. Therefore, there are  $n - 1$  comparisons, which is equivalent to a path of length  $n - 1$ .

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## Exercise 8.2

### Question 8.2-1

Illustrate the operation of **COUNTING-SORT** on the array  $A = \langle 6, 0, 2, 0, 1, 3, 4, 6, 1, 3, 2 \rangle$ .  
Running time:  $\Theta(n + k)$ . And if  $k = \mathcal{O}(n)$ , running time is  $\Theta(n)$ .

(a)

*A = Initial Array*

A

1	2	3	4	5	6	7	8	9	10	11
6	0	2	0	1	3	4	6	1	3	2

*C=Auxiliary Array*

C

0	1	2	3	4	5	6
2	2	2	2	1	0	2

*How many are there?*

(b)

*Add previous to current*

C

0	1	2	3	4	5	6
2	4	6	8	9	9	11

*How many are less than or equal to i?*

(c)

*After first iteration*

B

1	2	3	4	5	6	7	8	9	10	11
					2					

*A[11] = 2 C[2] = 6 B[6] = 2*

C

0	1	2	3	4	5	6
2	4	5	8	9	9	11

*Decrement C[2] after placing 2 in B*

(d)

*After second iteration*

B

1	2	3	4	5	6	7	8	9	10	11
					2		3			

*A[10] = 3 C[3] = 8 B[8] = 3*

C

0	1	2	3	4	5	6
2	4	5	7	9	9	11

*Decrement C[3] after placing 3 in B*

(e)

*After third iteration*

B

1	2	3	4	5	6	7	8	9	10	11
			1		2		3			

*A[9] = 1 C[1] = 4 B[4] = 1*

C

0	1	2	3	4	5	6
2	3	5	7	9	9	11

*Decrement C[1] after placing 1 in B*

(f)

*Final sorted output*

B

1	2	3	4	5	6	7	8	9	10	11
0	0	1	1	2	2	3	3	4	6	6

C

0	1	2	3	4	5	6
0	2	4	6	8	9	9

## Exercise 8.3

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### Question 8.3-1

Illustrate the operation of **RADIX-SORT** on the following list of English words: COW, DOG, SEA, RUG, ROW, MOB, BOX, TAB, BAR, EAR, TAR, DIG, BIG, TEA, NOW, FOX.

Running time:  $\Theta(d(n + k))$ .

#### PASS 1

SEA  
TEA  
MOB  
TAB  
DOG  
RUG  
DIG  
BIG  
BAR  
EAR  
TAR  
COW  
ROW  
NOW  
BOX  
FOX

#### PASS 2

TAB  
BAR  
EAR  
TAR  
SEA  
TEA  
DIG  
BIG  
MOB  
DOG  
COW  
ROW  
NOW  
BOX  
FOX  
RUG

#### PASS 3

BAR  
BIG  
BOX  
COW  
DIG  
DOG  
EAR  
FOX  
MOB  
NOW  
ROW  
RUG  
SEA  
TAB  
TAR  
TEA