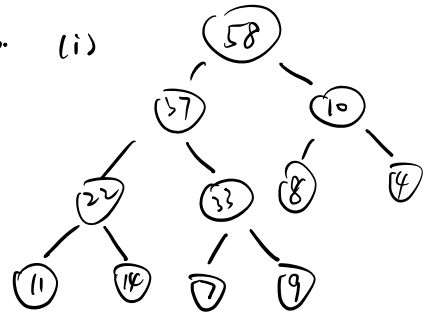
IS-19 1.a.

```
int isBST(struct TreeNode* node){
    if node == NULL return 1
    if node.left and node.left > node.value:
        return 0
    if node.right and node.right < node.value:
        return 0
    return isBST(node.left) and isBST(node.right)
```

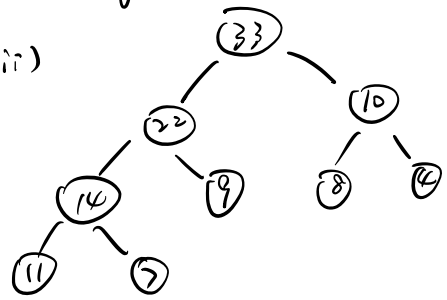
Time complexity O(n)

1.b. (i)

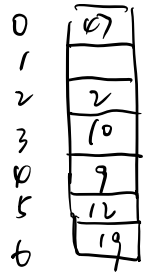


O(log n)

(ii)



1.c



10%7=3
2%7=2
12%7=5
19%7=5
9%7=2
47%7=5

h(16)=16%7=2 => 2, 3, 4, 5, 6, 0, 1

h(47)=47%7=5 => 5, 6, 0

2.a.

	1	2	3	4	5	1	5	1	6	7	8	5	8	9	2	4	5	4	2	9
	1	1	1	4	4	4	4	4	6	6	6	5	5	5	2	2	2	2	2	2
		2	2	2	5	5	5	5	5	7	7	7	7	9	9	9	5	5	5	9
			3	3	3	1	1	1	1	1	8	8	8	8	8	4	4	4	4	4
	x	x	x	x	x	x			x	x	x	x		x	x	x	x			x

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2.b (i)

	A	B	C	D	E
P_1	3	0	2	1	4
P_2	0	4	6	0	0
P_3	0	0	7	3	1
P_4	2	7	0	0	0
P_5	3	2	2	0	0

(ii) $P_5 \rightarrow P_2 \rightarrow P_3 \rightarrow \begin{cases} P_1 \rightarrow P_4 \\ P_4 \rightarrow P_1 \end{cases}$

safe.

2.c. $0.8 \times (20 + 200) + 0.2 \times (20 + 200 + 200) = 260$

3. a (i) $R_1 \leftarrow \sigma_{gender="F" \text{ AND } profit>1000000}(Actor \bowtie Role \bowtie Movie)$

$Answer \leftarrow \Pi_{AName}(R_1)$

a(ii) $R_1 \leftarrow \sigma_{year>=2009 \text{ AND } year<=2019 \text{ AND } gender='M'}(Actor \bowtie Role \bowtie Movie)$

$Answer \leftarrow {}_{AID}\mathcal{G}_{COUNT(MID),Sum(Pay)}(R_1)$

b(i) select AName from ACTOR natural join ROLE natural join MOVIE
where Gender = "F" AND Profit > 1000000

(ii) select AID, COUNT(MID), Sum(Pay) from ACTOR natural join ROLE natural join MOVIE
where Gender = "M" AND Year >= 2009 AND Year <= 2019
group by AID.

c.
(i) ACTOR: 5000/100 = 50 blocks

ROLE: 100000/100 = 1000 blocks

if Actor outter:
# Block $\lceil \frac{50}{6-2} \rceil \times 1000 + 50 = 25050$
# Disk seek $2 \times \lceil \frac{50}{6-2} \rceil = 50$

if Role outter:
# Block $\lceil \frac{1000}{6-2} \rceil \times 50 + 1000 = 26000$
# Disk seek $2 \times \lceil \frac{1000}{6-2} \rceil = 1000$

(ii) # Block: $\lceil \frac{50}{6-2} \rceil \times 1000 + 50 = 1050$

Disk seek: 2

4

a(i)

a	3	bd	4	bde	3
b	4	de	4		
c	5	be	3		
d	7	cd	4		
e	5				

closed: {a} {c} {d} {bd} {de} {cd} {bde}

maximal: {a} {cd} {bde}

a(ii) support(b→de) = $\frac{3}{8}$

confidence(b→de) = $\frac{3}{4}$

lift = $\frac{\frac{3}{8}}{\frac{4}{8} \times \frac{4}{8}} = 1.5 > 1$

not buy.

b. (i) ① $C_1=10: 10$ $C_2=20: 20$ $C_3=30: 30, 40, 50, 60$

② $C_1=10: 10$ $C_2=20: 20, 30$ $C_3=45: 40, 50, 60$

③ $C_1=10: 10$ $C_2=25: 20, 30$ $C_3=50: 40, 50, 60$.

(ii) SSE: $\sum_{i=1}^{n} \sum_{j=1}^{m} w^{(i,j)} = 0+5^2+5^2+10^2+0+10^2 = 250$

BSS: $\sum_{i=1}^{n} |p_i| (d(c_i, \bar{c}))^2 = 1 \times (10-35)^2 + 2 \times (25-35)^2 + 3 \times (50-35)^2 = 1500$

5. a(i) R N R N N | $P = \frac{2}{5}$ $R = \frac{1}{2}$

a(ii) R N R N N N N N R R

$\frac{1}{10}(\frac{1}{1} + \frac{2}{3} + \frac{3}{9} + \frac{4}{10})$

b(i) In isolated-term spelling correction, we attempt to correct a single query at a time.

b(ii) Directly compare each string in V with query string q, store its corresponding edit distance, then choose a minimum distance.

c.