

Q4**(a)**

i) P= SHE_SELLS_SEASHELLS

j	P[0..j]	P[1..j]	F[j]
0	S	-	0
1	SH	H	0
2	SHE	HE	0
3	SHE_	HE_	0
4	SHE_S	HE_S	1
5	SHE_SE	HE_SE	0
6	SHE_SEL	HE_SEL	0
7	SHE_SELL	HE_SELL	0
8	SHE_SELLS	HE_SELLS	1
9	SHE_SELLS_	HE_SELLS_	0
10	SHE_SELLS_S	HE_SELLS_S	1
11	SHE_SELLS_SE	HE_SELLS_SE	0
12	SHE_SELLS_SEA	HE_SELLS_SEA	0
13	SHE_SELLS_SEAS	HE_SELLS_SEAS	1
14	SHE_SELLS_SEASH	HE_SELLS_SEASH	2
15	SHE_SELLS_SEASHE	HE_SELLS_SEASHE	3
16	SHE_SELLS_SEASHEL	HE_SELLS_SEASHEL	0
17	SHE_SELLS_SEASHELL	HE_SELLS_SEASHELL	0
18	SHE_SELLS_SEASHELLS	HE_SELLS_SEASHELLS	1

ii) P= ABRACADABRACADABRA

j	P[0..j]	P[1..j]	F[j]
0	A	-	0
1	AB	B	0
2	ABR	BR	0
3	ABRA	BRA	1
4	ABRAC	BRAC	0
5	ABRACA	BRACA	1
6	ABRACAD	BRACAD	0
7	ABRACADA	BRACADA	1
8	ABRACADAB	BRACADAB	2
9	ABRACADABR	BRACADABR	3
10	ABRACADABRA	BRACADABRA	4
11	ABRACADABRAC	BRACADABRAC	5
12	ABRACADABRACA	BRACADABRACA	6
13	ABRACADABRACAD	BRACADABRACAD	7
14	ABRACADABRACADA	BRACADABRACADA	8

15	ABRACADABRACADAB	BRACADABRACADAB	9
16	ABRACADABRACADABR	BRACADABRACADABR	10
17	ABRACADABRACADABRA	BRACADABRACADABRA	11

iii) P= ABRACADABRACAPABRA

j	P[0..j]	P[1..j]	F[j]
0	A	-	0
1	AB	B	0
2	ABR	BR	0
3	ABRA	BRA	1
4	ABRAC	BRAC	0
5	ABRACA	BRACA	1
6	ABRACAD	BRACAD	0
7	ABRACADA	BRACADA	1
8	ABRACADAB	BRACADAB	2
9	ABRACADABR	BRACADABR	3
10	ABRACADABRA	BRACADABRA	4
11	ABRACADABRAC	BRACADABRAC	5
12	ABRACADABRACA	BRACADABRACA	6
13	ABRACADABRACAP	BRACADABRACAP	0
14	ABRACADABRACAPA	BRACADABRACAPA	1
15	ABRACADABRACAPAB	BRACADABRACAPAB	2
16	ABRACADABRACAPABR	BRACADABRACAPABR	3
17	ABRACADABRACAPABRA	BRACADABRACAPABRA	4

iv) P= ABRACADABRACABABRA

j	P[0..j]	P[1..j]	F[j]
0	A	-	0
1	AB	B	0
2	ABR	BR	0
3	ABRA	BRA	1
4	ABRAC	BRAC	0
5	ABRACA	BRACA	1
6	ABRACAD	BRACAD	0
7	ABRACADA	BRACADA	1
8	ABRACADAB	BRACADAB	2
9	ABRACADABR	BRACADABR	3
10	ABRACADABRA	BRACADABRA	4
11	ABRACADABRAC	BRACADABRAC	5
12	ABRACADABRACA	BRACADABRACA	6
13	ABRACADABRACAB	BRACADABRACAB	2

14	ABRACADABRACABA	BRACADABRACABA	1
15	ABRACADABRACABAB	BRACADABRACABAB	2
16	ABRACADABRACABABR	BRACADABRACABABR	3
17	ABRACADABRACABABRA	BRACADABRACABABRA	4

(b)

i)

failureArray(P):

P: String (pattern)

returns failure array

```

1. F[0] ← 0           // F is our failure array
2. i ← 1
3. j ← 0
4. while i < len(P) do
    // Continue to match suffix
    // Keep matching if we encounter wildcard character ?
5.     if P[i] = P[j] or P[i] = '?' or P[j] = '?' then
6.         j++
7.         F[i] ← j
8.         i++
9.     else if j > 0 then
10.        j ← F[j-1]
11.    else
12.        F[i] ← 0
13.        i++
14
15. return F

```

KMP(T, P):

T: Text

P: Pattern

returns the first match

```

1. F ← failureArray(P)
2. i ← 0
3. j ← 0
4. while i < len(T) do
    // Keep matching if we encounter wildcard character ?
5.     if T[i] = P[j] or P[j] = '?' then
6.         if j = len(P) - 1 then
7.             return i - j           // match
8.         else
9.             i++
10.            j++

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11.     else
12.         if j > 0 then
13.             j ← F[j - 1]
14.         else
15.             i++
16. return -1                                // no match

```

ii)

P= S?E_SE?LS_SEASHELLS

j	P[0..j]	P[1..j]	F[j]
0	S	-	0
1	S?	?	1
2	S?E	?E	0
3	S?E_	?E_	0
4	S?E_S	?E_S	1
5	S?E_SE	?E_SE	2
6	S?E_SE?	?E_SE?	3
7	S?E_SE?L	?E_SE?L	0
8	S?E_SE?LS	?E_SE?LS	1
9	S?E_SE?LS_	?E_SE?LS_	2
10	S?E_SE?LS_S	?E_SE?LS_S	1
11	S?E_SE?LS_SE	?E_SE?LS_SE	2
12	S?E_SE?LS_SEA	?E_SE?LS_SEA	0
13	S?E_SE?LS_SEAS	?E_SE?LS_SEAS	1
14	S?E_SE?LS_SEASH	?E_SE?LS_SEASH	2
15	S?E_SE?LS_SEASHE	?E_SE?LS_SEASHE	3
16	S?E_SE?LS_SEASHEL	?E_SE?LS_SEASHEL	0
17	S?E_SE?LS_SEASHELL	?E_SE?LS_SEASHELL	0
18	S?E_SE?LS_SEASHELL	?E_SE?LS_SEASHELLS	1

P= ABRACADABRAC???BRA

j	P[0..j]	P[1..j]	F[j]
0	A	-	0
1	AB	B	0
2	ABR	BR	0
3	ABRA	BRA	1
4	ABRAC	BRAC	0
5	ABRACA	BRACA	1
6	ABRACAD	BRACAD	0
7	ABRACADA	BRACADA	1
8	ABRACADAB	BRACADAB	2

9	ABRACADABR	BRACADABR	3
10	ABRACADABRA	BRACADABRA	4
11	ABRACADABRAC	BRACADABRAC	5
12	ABRACADABRAC?	BRACADABRAC?	6
13	ABRACADABRAC??	BRACADABRAC??	7
14	ABRACADABRAC???	BRACADABRAC???	8
15	ABRACADABRAC???B	BRACADABRAC???B	9
16	ABRACADABRAC???BR	BRACADABRAC???BR	10
17	ABRACADABRAC???BRA	BRACADABRAC???BRA	11