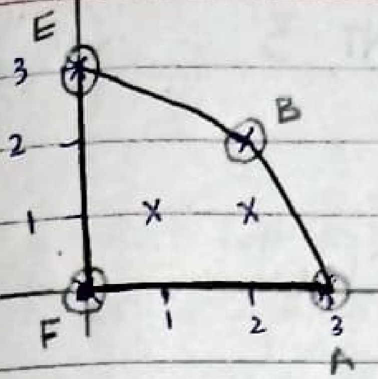
23K-0066
BS(AI)-5A

DAA ASSIGNMENT 3

Q1:

Step	Current point p	Candidate (q)	checking point (r)	orientation (p,q,r)	More CCW?	New Candidate
1	F(0,0)	A(0,3)	B(2,2)	(0-0)(2-0) - (3-0)(2-0) = ~~6~~ -6	No	-
2	F(0,0)	A(0,3)	C(1,1)	(0-0)(1-0) - (3-0)(1-1) = 0	No	-
3	F(0,0)	A(0,3)	D(2,1)	(0-0)(1-0) - (3-0)(2-0) = -6	No	-
4	F(0,0)	A(0,3)	E(3,0)	(0-0)(0-0) - (3-0)(3-0) = -9	No	-
5	A(0,3)	B(2,2)	C(1,1)	(2-0)(1-3) - (2-3)(1-0) = -3	No	-
6	A(0,3)	B(2,2)	D(2,1)	(2-0)(1-3) - (2-3)(2-0) = -2	No	-
7	A(0,3)	B(2,2)	E(3,0)	(2-0)(0-3) - (2-3)(3-0) = -3	No	-
8	A(0,3)	B(2,2)	F(0,0)	(2-0)(0-3) - (2-3)(0-0) = -6	No	-
9	B(2,2)	C(1,1)	D(2,1)	(1-2)(1-2) - (1-2)(2-2) = 2	Yes	D
10	B(2,2)	D(2,1)	E(3,0)	(2-2)(0-2) - (1-2)(3-2) = 1	Yes	E
11	B(2,2)	E(3,0)	F(0,0)	(3-2)(0-2) - (0-2)(0-2) = -6	No	-
12	B(2,2)	E(3,0)	A(0,3)	(3-2)(3-2) - (0-2)(0-2) = -3	No	-
13	B(2,2)	E(3,0)	C(1,1)	(3-2)(1-2) - (0-2)(1-2) = -3	No	-
14	E(3,0)	F(0,0)	A(0,3)	= (0-3)(3-0) - (0-0)(0-3) = -9	No	-
15	E(3,0)	F(0,0)	B(2,2)	(0-3)(2-0) - (0-0)(2-3) = -6	No	-
16	E(3,0)	F(0,0)	C(1,1)	(0-3)(1-0) - (0-0)(1-3) = -3	No	-
17	E(3,0)	F(0,0)	D(2,1)	(0-3)(1-0) - (0-0)(2-3) = -3	No	-

F → A → B → E → F



F → A → B → E → F

Q2)

Brute force:

```
bruteForceFF(P):
    m = length(P)
    F = array of size m
    for j=0 to m-1:
        F[j] = 0
        for k = j down to 1:
            match = True
            for i=0 to k-1:
                if p[i] != p[j-k+1+i]:
                    match = False
                    break
            if match:
                F[j] = k
                break
    return F
```

P = ababaca

j	Substring P[0..j]	longest proper prefix = sofix	F[j]
0	a	–	0
1	ab	–	0
2	aba	a	1
3	abab	ab	2
4	ababa	aba	3
5	ababac	–	0
6	ababaca	a	1

Result: F = [0, 0, 1, 2, 3, 0, 1]

Time complexity:

outer loop = O(m)

middle loop = O(m) in worst case

inner loop = O(m) in worst case

Total: $O(m^3)$ worst case

Optimized KMP:

Compute Failure KMP (P):

m = length (P)

F = array of size m

F[0] = 0

l = 0

```
for j=1 to m-1 :
    while i > 0 and P[i] != P[j] :
        i = F[i-1]
    if P[i] == P[j] :
        i = i+1
    else :
        i = 0
    F[j] = i
return F
```

We compute F[j] using previously computed F values. We maintain a pointer i which is the length of the current longest prefix which is also a suffix for P[0...j-1]. For next j, we try to extend by comparing P[i] with P[j]. If they match, F[j] = i+1. If not we set i = F[i-1] and repeat until match or i = 0

Time Complexity :

The while loop runs at most $O(m)$ total across all j because i increases at most by 1 per step, and decreases only via i = F[i-1] which is less than i.

So TC = $O(m)$

j	P[j]	comparison	i_{before}	i_{after}	F[j]
0	-	-	0	-	0
1	~~P~~ b	P[0] != P[1]	0	0	0
2	a	P[0] == P[2]	0	1	1
3	b	P[1] == P[3]	1	2	2
4	a	P[2] == P[4]	2	3	3
5	c	P[3] != P[5]	3	1	
~~6~~		P[1] != P[5]	1	0	
		P[0] != P[5]	0	0	0
6	a	P[0] == P[5]	0	1	1

F = [0, 0, 1, 2, 3, 0, 1]

Comparison:

	Brute-Force	Optimized KMP
Time complexity	$O(m^3)$	$O(m)$
Character comparisons	Upto $O(m^3)$	$O(m)$
Reuse of computed Info	No reuse	Reuses F values via backtracking
Pratical efficiency	Slow for long patterns	Fast, used in real KMP matcher