

Q.3

a) Calculating CPTs

9	π	Probability
D	0	0
N	3	0.75
P	0	0
V	1	0.25

a(p, q)	D	N	P	V	Sum
D	0	1	0	0	1
N	0	0	1	3	4
P	1	1	0	0	2
V	0	3	1	0	4

b(q, 0)	au	auts	arrow	flier	like	swat	time	sum
D	1	0	0	0	0	0	0	1
N	0	2	2	3	0	0	1	8
P	0	0	0	0	2	0	0	2
V	0	0	0	1	2	1	0	4

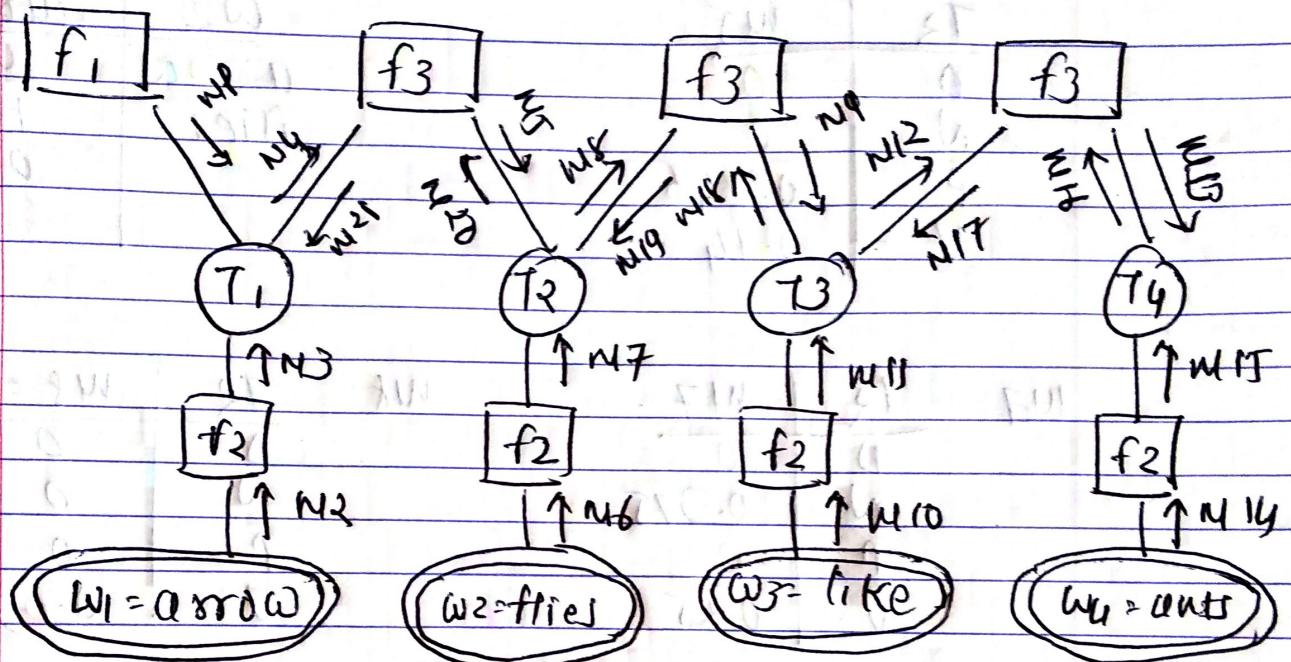
⇒ Now, Estimated probability by dividing sum

$b(9,0)$	au	auts	arrow	fliers	like	swat	time
D	1/1	0	0	0	0	0	0
N	0	2/8	2/8	3/8	0	0	1/8
P	0	0	0	0	2/8	0	0
V	0	0	0	1/4	2/4	1/4	0

⇒ And, we get resulting table as follows

T_i	w_i	$P(w_i T_i)$
D	au	$1/1 = 1$
D	*	0
N	auts	$2/8 = 0.25$
N	arrow	$2/8 = 0.25$
N	fliers	$3/8 = 0.375$
N	time	$1/8 = 0.125$
N	*	0
P	like	$2/8 = 1$
P	*	0
V	fliers	$1/4 = 0.25$
V	like	$2/4 = 0.5$
V	swat	$1/4 = 0.25$
V	*	0

(b) factor graph - "arrow flies like ants"



c) finding optimal T_1, T_2, T_3, T_4
by calculating necessary messages

N_1	T_1	w_1
D		0
N		0.75
P		0
V		0.25

N_2	w_1	w_2
arrow	1	
flies	0	
		0
		0

N_3	T_1	w_3
D		0
N		0.25
P		0
V		0

N_4	T_1	$w_4 = w_1 * w_3$
D		0
N		3/16
P		0
V		0

$w_3 = w_4 \cdot f_3$ (approx) - w_3 (approx) - (1)

T_3	w_3
D	0
N	0
P	0.046
V	0.14

w_2	w_3
arrow	0
flies	1
	0
	;

T_2	w_7
D	0
N	0.375
P	0
V	0.25

T_2	$w_8 = w_5 \cdot w_7$
D	0
N	0
P	0
V	0.035

T_3	w_9
D	0
N	0.026
P	0.008
V	0

w_{10}	w_2	w_{10}
fly	like	0
	1	0
	;	;

T_3	w_{11}
D	0
N	0
P	1
V	0.5

T_3	$w_{12} = w_9 \cdot w_{11}$
D	0
N	0
P	0.008
V	0

<u>W13</u> : <u>T4</u>	<u>W13</u>	<u>W14</u> : <u>W4</u>	<u>W14</u>
D	0.004	like	0
N	0.004	auto	1
P	0	1	0
V	0	100.0	1
		0	

<u>W15</u> : <u>T4</u>	<u>W15</u>
D	0
N	0.25
P	0
V	0

→ To maximize product of T4:

<u>T4</u>	<u>W13, W15</u>
D	0
N	0.001
P	0
V	0

<u>W16</u> : <u>T4</u>	<u>W16</u>	<u>W17</u> : <u>T3</u>	<u>W17</u> = <u>W16</u> × <u>f3</u>
D	0	D	0.25
N	0.25	N	0
P	0	P	0.125
V	0	V	0.187

→ To find optimal value of T_3 :

T_3	w_9, w_{11}, w_{17}	A
D	0	$w_9 = 0$
N	0	$w_{11} = 0$
P	0.001	$w_{17} = 0$
V	0	$\therefore T_3 = P$

w_{18}	T_3	w_{11}, w_{17}	$w_9 = T_2$	$w_9 = w_{18}, f_3$
D	0	$w_{18} = 0$	D	0
N	0	0	N	0
P	0.125	0	P	0
V	0.093	0	V	0.023

→ To find optimal value of T_2 :

T_2	w_5, w_9, w_{19}	$w_9 = T_2$	$w_9 = w_{18}, f_3$
P	0	P	0
N	0	N	0
P	0	P	0
V	0.0008	V	0.023

$w_{20} = T_2$	$w_{20} = w_7, w_{19}$	$w_{21} = T_1$	$w_{21} = w_{20}, f_3$
D	0	D	0
N	0	N	0.003
P	0	P	0
V	0.005	V	0

→ To find optimal value for T_1 .

T_1	<u>w_1, w_2, w_{21}</u>
D	0
N	0.0005
P	0
V	0

$$\therefore \underline{T_1 = N}$$

Optimal values we got are:

$$T_1^* = N$$

$$T_2^* = V$$

$$T_3^* = P$$

$$T_4^* = N$$