Vidyavardhini's College of Engineering and Technology

Department of Artificial Intelligence & Data Science

AY: 2025-26

Class:	AI	**Semester:**	VII
Course Code:	CSC702	**Course Name:**	BDA

Name of Student:	BARI ANKIT VINOD
Roll No. :	61
Assignment No.:	4
Title of Assignment:	
Date of Submission:	15/9/25
Date of Correction:	17/9/25

Evaluation

Performance Indicator	Max. Marks	Marks Obtained
Completeness	5	4
Demonstrated Knowledge	3	2
Legibility	2	2
Total	10	8

Performance Indicator	Exceed Expectations (EE)	Meet Expectations (ME)	Below Expectations (BE)
Completeness	5	3-4	1-2
Demonstrated Knowledge	3	2	1
Legibility	2	1	0

Checked by

Name of Faculty : Ms. Sweety Patil

Signature :

Date : 17/9/25

Assignment No. 4

BDA

Q. 1) Suppose a data stream of the integers 3, 1, 4, 1, 5, 9, 2, 6, 5 let the hash function being used $h(x) = 3x + 1 \bmod 5$; show how the Flajolet-Martin algorithm will estimate the number of distinct element in this stream.

→ here, Stream = 3, 1, 4, 1, 5, 9, 2, 6, 5

hash = $3x + 1 \bmod 5$

S1- Compute hash values -

$h(3) = 10 \bmod 5 = 0$

$h(1) = 4 \bmod 5 = 4$

$h(4) = 13 \bmod 5 = 3$

$h(1) = 4$

$h(5) = 16 \bmod 5 = 1$

$h(9) = 28 \bmod 5 = 3$

$h(2) = 7 \bmod 5 = 2$

$h(6) = 19 \bmod 5 = 4$

$h(5) = 1$

S2- Convert to binary (use 3 bits)

0 = 000, 1 = 001, 2 = 010, 3 = 011, 4 = 100

S3- For each hash value compute p = number of trailing zeros

0 (000) → p = 3

4 (100) → p = 2

3 (011) → p = 0

4 → 2

1 (010) → 1

3 → 0

2 (010) → 1

4 → 2

1 → 0

∴ Observed values = {3, 2, 0, 2, 0, 0, 1, 2, 0} ∴ Maximum R = 3

S4- FM Estimate -

$$\hat{n} = \frac{2^R}{\phi} = \frac{8}{0.77} \approx 10.34$$

∴ Stream's case {1, 2, 3, 4, 5, 6, 9} → 7

Q. 2) Let, $n = 10$, $k = 3$, $S = \{14, 25\}$, check membership of 16 and 33. hash functions - $h_1(x) = x \% 10$, $h_2(x) = (2x + 3) \% 10$, $h_3(x) = (3x + 1) \% 10$.

→ given, $n = 10$, $k = 3$, $S = \{14, 25\}$

hash fun^n : $h_1(x) = x \bmod 10$, $h_2(x) = (2x + 3) \bmod 10$, $h_3(x) = (3x + 1) \bmod 10$

S1- Insert 14 -

$h_1(14) = 14 \bmod 10 = 4$

$h_2(14) = (28 + 3) \bmod 10 = 31 \bmod 10 = 1$

$h_3(14) = (42 + 1) \bmod 10 = 43 \bmod 10 = 3$

∴ set bit's at positions 1, 3, 4.

S2- Insert 25 -

$h_1(25) = 25 \bmod 10 = 5$

$h_2(25) = (50 + 3) \bmod 10 = 53 \bmod 10 = 3$

$h_3(25) = (75 + 1) \bmod 10 = 76 \bmod 10 = 6$

∴ set bit's at positions 5, 3, 6.

Index	0	1	2	3	4	5	6	7	8	9
value	0	1	0	1	1	1	1	0	0	0

S3- Check membership of 16 -

$h_1(16) = 16 \bmod 10 = 6$

$h_2(16) = (32 + 3) \bmod 10 = 35 \bmod 10 = 5$

$h_3(16) = (48 + 1) \bmod 10 = 49 \bmod 10 = 9$

∴ set one bit 0, 16

S4- check membership of 33

$h_1(33) = 33 \bmod 10 = 3$

$h_2(33) = (66 + 3) \bmod 10 = 69 \bmod 10 = 9$

$h_3(33) = (99 + 1) \bmod 10 = 100 \bmod 10 = 0$

∴ since not all bit's are set,

- final Answer -

16 → Not in the set

33 → Not in the set