

# Experiments on Probability

**Objective:** - To appreciate that finding probability through experiment is different from finding probability by calculation. Students become sensitive towards the fact that if they increase the number of observations, probability found through experiment approaches the calculated probability.

**Description :-** (i) The teacher asked us to either work individually or at most in groups.

(ii) I collected the following data by visiting say 10 classrooms in the school.

(iii) I obtained the fraction of number of children having their birthday in the month of January, February, .....December from the data given in the table.

(iv) I made a pie-diagram from the recorded data.

(v) I investigated that fraction actually obtained in step 3 tallies with the calculated probability obtained for each month.

If total no. of children whose birthday falls in month of January is 38 and the total number of students is 500.

The actual fraction of children born in January =  $\frac{38}{500}$

Probability for a child to have birthday in January =  $\frac{31}{365}$

(vi) The students increased the sample size, i.e. increased the number of observations and studied if the actual fraction approaches the calculated probability. I used a random sample for this purpose.

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**Calculation of probability by using formula (theoretical values)**

$$\text{Probability for a child to have Birthday in January} = \frac{31}{365} = 0.08$$

$$\text{Probability for a child to have Birthday in February (leap year)} = \frac{29}{365} = 0.079$$

$$\text{Probability for a child to have Birthday in March} = \frac{31}{365} = 0.08$$

$$\text{Probability for a child to have Birthday in April} = \frac{30}{365} = 0.082$$

$$\text{Probability for a child to have Birthday in May} = \frac{31}{365} = 0.084$$

$$\text{Probability for a child to have Birthday in June} = \frac{30}{365} = 0.082$$

$$\text{Probability for a child to have Birthday in July} = \frac{31}{365} = 0.084$$

$$\text{Probability for a child to have Birthday in August} = \frac{31}{365} = 0.084$$

$$\text{Probability for a child to have Birthday in September} = \frac{30}{365} = 0.082$$

$$\text{Probability for a child to have Birthday in October} = \frac{31}{365} = 0.084$$

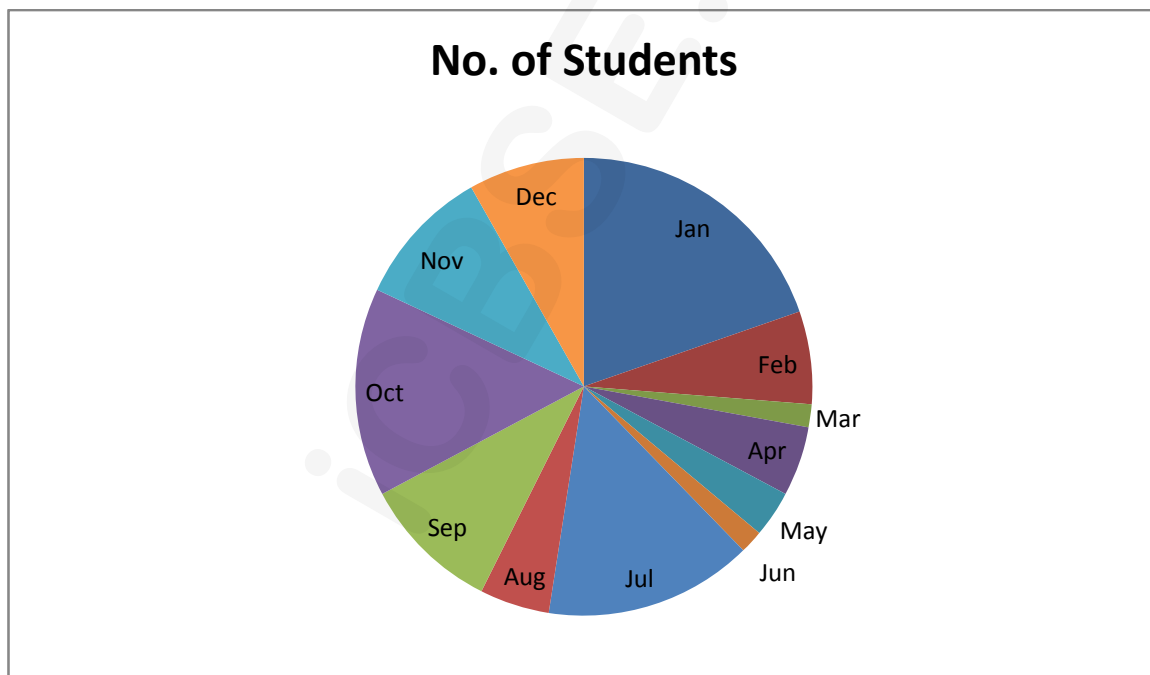
$$\text{Probability for a child to have Birthday in November} = \frac{30}{365} = 0.082$$

$$\text{Probability for a child to have Birthday in December} = \frac{31}{365} = 0.084$$

Table 1

**Number of students having Birthday in various months in 1 class**

Class	No. of students	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
VI C	61	12	4	1	3	2	1	9	3	6	9	6	5



Calculation of probability based on these observations (only 1 class of 61 students)

**These are actual experimental values**

$$\text{Probability in month of January} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{12}{61} = 0.19$$

$$\text{Probability in month of February} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{4}{61} = 0.06$$

$$\text{Probability in month of March} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{1}{61} = 0.16$$

$$\text{Probability in month of April} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{3}{61} = 0.05$$

$$\text{Probability in month of May} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{2}{61} = 0.03$$

$$\text{Probability in month of June} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{1}{61} = 0.16$$

$$\text{Probability in month of July} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{9}{61} = 0.15$$

$$\text{Probability in month of August} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{3}{61} = 0.05$$

$$\text{Probability in month of September} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{6}{61} = 0.09$$

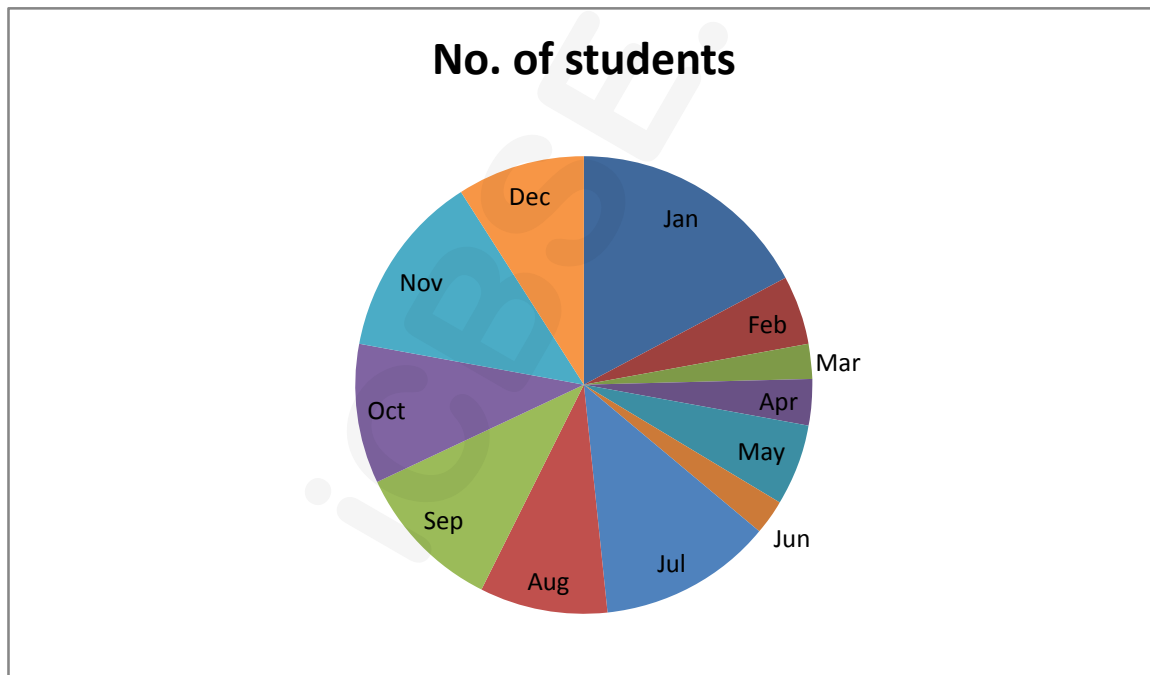
$$\text{Probability in month of October} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{9}{61} = 0.15$$

$$\text{Probability in month of November} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{6}{61} = 0.09$$

$$\text{Probability in month of December} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{5}{61} = 0.08$$

### Number of students having Birthday in various months in 2 classes

Class	No. of students	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
VI C	61	12	4	1	3	2	1	9	3	6	9	6	5
VI D	61	9	2	2	1	5	2	6	8	7	3	10	6



Calculation of probability based on these observations (only 2 classes 122 students)

**These are actual experimental values**

Probability in month of January	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{12}{122} = 0.09$
Probability in month of February	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{4}{122} = 0.03$
Probability in month of March	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{1}{122} = 0.01$
Probability in month of April	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{3}{122} = 0.02$
Probability in month of May	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{2}{122} = 0.02$
Probability in month of June	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{1}{122} = 0.01$
Probability in month of July	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{9}{122} = 0.07$
Probability in month of August	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{3}{122} = 0.02$
Probability in month of September	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{6}{122} = 0.05$
Probability in month of October	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{9}{122} = 0.07$
Probability in month of November	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{6}{122} = 0.05$
Probability in month of December	$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$	$= \frac{5}{122} = 0.04$

### Number of students having Birthday in various months in 10 classes

Class	No. of students	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
VI C	61	12	4	1	3	2	1	9	3	6	9	6	5
VI D	61	9	2	2	1	5	2	6	8	7	3	10	6
VII B	59	3	4	2	3	4	5	4	5	5	10	8	5
VIIIA	56	4	6	4	5	1	3	2	7	5	6	10	3
VIIIC	57	3	5	7	1	4	5	8	2	6	2	9	5
VIIID	61	8	2	10	3	8	5	1	6	4	6	4	4
IX B	60	6	2	5	1	4	6	6	4	3	5	5	13
IX D	58	12	6	7	2	3	5	1	4	2	4	5	7
X B	53	9	7	6	4	1	3	3	5	6	4	1	4
X D	54	8	1	4	6	3	7	8	2	7	1	2	5
Total	580	74	39	48	29	34	42	48	46	51	50	60	58



$$\text{Probability in month of January} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{74}{580} = 0.12$$

$$\text{Probability in month of February} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{39}{580} = 0.06$$

$$\text{Probability in month of March} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{48}{580} = 0.08$$

$$\text{Probability in month of April} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{29}{580} = 0.05$$

$$\text{Probability in month of May} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{35}{580} = 0.06$$

$$\text{Probability in month of June} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{42}{580} = 0.07$$

$$\text{Probability in month of July} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{48}{580} = 0.08$$

$$\text{Probability in month of August} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{46}{580} = 0.07$$

$$\text{Probability in month of September} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{51}{580} = 0.08$$

$$\text{Probability in month of October} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{50}{580} = 0.08$$

$$\text{Probability in month of November} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{60}{580} = 0.10$$

$$\text{Probability in month of December} = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{58}{580} = 0.1$$

Month	No. of children	Angle
January	74	46
February	39	24.2
March	48	29.8
April	29	18
May	35	21.7
June	42	26.1
July	48	29.8
August	46	28.6
September	51	31.7
October	50	31
November	60	37.2
December	58	36
Total	580	360

Observation :- I observed that as the no. of students increases the experimental probability and that calculated with formula become almost equal.

