

Experiment no: 7: Experiment on chi -square test and probability

Aim: Solving problems on probability and chi square test

Probability:

Probability is the likelihood of occurrence of an event. In daily life, each one of us is often faced with decision about the likelihood that an event will or will not occur

E.g.: Before commencement of examinations .is student anxious about the likely hood of his doing well in the examinations. The likelihood of obtaining good marks in an examination may be influence by a number of factors

Events: An event is the occurrence of something. The occurrence of head or tail in a toss is an event. Similarly, new born baby being boy or girl is also an event

Formula: $p=1/n$

Q1. A pea plant is heterozygous for 2 genes (TtRRYy) where, T=Tall, t=dwarf, R=round seed r=wrinkled seed, Y=yellow seed, y= green seed, If this plant is self-fertilized what are the predicated phenotypes offspring what fractions of the offspring will occur in each category What fraction of progeny will be tall round and green?

Solution:

TtRRYy XTtRRYy

	TRY	TRy	tRY	tRy
TRY	TTRRYY (tall, round, yellow)	TTRRYy (tall, round, yellow)	TtRRYY (tall, round, yellow)	TtRRYy (tall, round, yellow)
TRy	TTRRYy (tall, round, yellow)	TTRRyy(tall, round, green)	TtRRYy (tall, round, yellow)	TtRRyy (tall, round, green)
tRY	TtRRYY (tall, round, yellow)	TtRRYy (tall, round, yellow)	ttRRYY (dwarf, round, yellow)	ttRRYy (dwarf, round, yellow)
tRy	TtRRYy (tall, round, yellow)	TtRRyy (tall, round, green)	ttRRYy (dwarf, round, yellow)	ttRRyy (dwarf, round, green)

tall, round, yellow-9/16

dwarf, round, yellow-3/16

tall, round, green-3/16

dwarf, round, green-1/16

Here, tall, round, green, are 3/16

Fraction of progeny tall, round, green will be 3/16

2. A pea plant is heterozygous for 3 genes (TtRrYy) where, T=Tall, t=dwarf, R=round seed r=wrinkled seed, Y=yellow seed, y= green seed. If this plant is self-fertilized what

are the predicated phenotypes offspring? What fractions of the offspring will occur in each category?

Solution: By applying alternative forked line method here, predicted phenotypes is (2^n) i.e. 8 and the fraction of the offspring is as follows

$\frac{27}{64}$ (tall, round, yellow) $\frac{9}{64}$ (tall, round, green) $\frac{9}{64}$ (tall, wrinkled, yellow) $\frac{3}{64}$ (tall, green, wrinkled) $\frac{9}{64}$ (dwarf, round, yellow) $\frac{3}{64}$ (dwarf, round, green) $\frac{3}{64}$ (dwarf, wrinkled, yellow) $\frac{1}{64}$ (dwarf, wrinkled, green)

Chi-square:

Q 2. F1 generation, all offspring have straight wings and gray body of drosophila. In F₂ generation out of 352 total flies, 193 are straight wing and gray bodies, 69 straight wings, along body, 64 curved wings, gray body 26 curved wings boney body apply chi square test for the given data

Solution:

Given data,

Straight wing gray bodies =193

Straight wing ebony bodies = 59

Curved wing gray bodies = 64

Curved wing ebony bodies= 26

Total no of files =352

Expected values based on the Mendelian law of independent assortment (9:3:3:1) are as follows

Here straight wing gray bodies are dominant over curved wing on ebony bodies respectively

Straight wing gray bodies= $\frac{9}{16} \times 352 = 198$

Straight wing ebony bodies

= $\frac{3}{16} \times 352 = 66$ Curved wing gray

bodies = $\frac{3}{16} \times 352 = 66$ Curved wing

ebony bodies= $\frac{4}{16} \times 352 = 22$

Phenotype	Expected data (E)	Observed data (O)	O-E	(O-E) ²	χ^2
Straight, gray	198	193	-5	25	0.126
Straight, ebony	66	69	3	9	0.136
Curved, gray	66	64	-2	4	0.060
Curved, ebony	22	26	4	16	0.727

TOTAL	352	352			1.049
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Hence, the value of χ^2 is 1.049

CHI-SQUARE TABLE WITH RESPECTIVE DEGREE OF FREEDOM

Degree of freedom	P=0.099	0.95	0.80	0.50	0.20	0.05	0.01
1	0.000157	0.00393	0.0642	0.455	1.642	3.841	6.635
2	0.020	0.103	0.446	1.386	3.219	5.991	9.210
3	0.115	0.352	1.005	2.366	4.642	7.815	11.354
4	0.297	0.711	1.649	3.357	5.989	9.488	13.277
5	0.554	1.145	2.343	4.351	7.289	11.070	15.086
6	0.872	1.635	3.070	5.348	8.558	12.592	16.812
7	1.239	2.167	3.822	6.346	9.803	14.067	18.475
8	1.646	2.733	4.595	7.344	11.030	15.067	20.090
9	2.088	3.325	5.380	8.343	12.242	16.919	21.666
10	2.588	3.940	6.179	9.342	13.442	18.919	23.209
15	5.229	7.261	10.307	14.339	19.311	18.307	30.578
20	8.260	10.851	14.578	19.337	25.038	24.996	37.566
25	1.524	14.611	18.940	24.337	30.675	31.410	44.314
30	14.953	18.493	23.304	29.336	36.750	43.773	50.892

Here the value of chi -square i.e. **1.049** is less than the table of **7.815** at **0.05** p and **3** degrees of freedom hence, the null hypothesis is accepted.

CLASS WORK

1. Work out of given problem on probability and chi square test.

