

# Solution For Problemes On Probability and Statics

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**Abstract**—This document includes different problems and solution on probability and statics. It also provides the information about the python and latex codes of figures.

Download all python codes from

```
svn co https://github.com/yogi13995/
  yogesh_training/tree/master/Geometry/
  probability/codes
```

and latex-tikz codes from

```
svn co https://github.com/yogi13995/
  yogesh_training/tree/master/Geometry/
  probability/figures
```

recorded:

No. of girls in a family	2	1	0
No. of families	475	814	211

Compute the probability of a family, chosen at random, having

- (i) 2 girls
- (ii) 1 girl
- (iii) No girl

Also check whether the sum of these probabilities is 1.

## 1 PROBABILITY

### 1.1 Problem1

#### 1.1.1 question:

- In a cricket match, a batswoman hits a boundary 6 times out of 30 balls she plays. Find the probability that she did not hit a boundary.

#### 1.1.2 Solution:

- let assume  $P(A)$  be the probability of hitting 6 so

$$P(A) = \frac{6}{30} \quad (1.1.1.1)$$

$$= \frac{1}{5} \quad (1.1.1.2)$$

$P(B)$  be the probability of not hitting the boundry

$$P(B) = 1 - P(A) \quad (1.1.1.3)$$

$$= 1 - \frac{1}{5} \quad (1.1.1.4)$$

$$= \frac{4}{5} \quad (1.1.1.5)$$

### 1.2 Problem2

#### 1.2.1 question:

- 1500 families with 2 children were selected randomly, and the following data were

- probability of having two girls in a family

$$= \frac{\text{Favourable cases}}{\text{total cases}} \quad (1.2.1.1)$$

$$= \frac{\text{No. of families having 2 girls}}{\text{total No. of families}} \quad (1.2.1.2)$$

Let assume that the probability of chosen family will have 2 girls be  $P(A)$  so

$$P(A) = \frac{475}{1500} \quad (1.2.1.3)$$

$$= 0.316 \quad (1.2.1.4)$$

- probability of having one girl in a family

$$= \frac{\text{No. of families having 1 girl}}{\text{total No. of families}} \quad (1.2.2.1)$$

Let assume that the probability of chosen family will have 1 girl be  $P(B)$  so

$$P(B) = \frac{814}{1500} \quad (1.2.2.2)$$

$$= 0.5427 \quad (1.2.2.3)$$

3. probability of having one girl in a family

$$= \frac{\text{No. of families having no girl}}{\text{total No. of families}} \quad (1.2.3.1)$$

Let assume that the probability of chosen family will have no girl be  $P(C)$  so

$$P(C) = \frac{211}{1500} \quad (1.2.3.2)$$

$$= 0.1407 \quad (1.2.3.3)$$

$$P(A) + P(B) + P(C) = 0.316 + 0.5427 + 0.1407 \quad (1.2.3.4)$$

$$= 1 \quad (1.2.3.5)$$

### 1.3 Problem3

1.3.1 question:

1. Three coins are tossed simultaneously 200 times with the following frequencies of different outcomes:

Outcome	3 heads	2 heads	1 head	No head
Frequency	23	72	77	28

If the three coins are simultaneously tossed again, compute the probability of 2 heads coming up.

1.3.2 Solution:

1. No. of cases when three coins are tossed simultaneously

$(T, T, T), (T, T, H), (T, H, T)$

$(T, H, H), (H, H, H), (H, T, T)$

$(H, T, H), (H, H, T)$

No. of 2 heads cases = 3

Let assume that the probability of 2 heads coming up is  $P(A)$  so

$$P(A) = \frac{\text{cases of No of two heads}}{\text{No of total cases}} \quad (1.3.1.1)$$

$$= \frac{3}{8} \quad (1.3.1.2)$$

### 1.4 Problem4

1.4.1 question:

1. Refer the table given below.

Marks	Number of students
0-20	7
20-30	10
30-40	10
40-50	20
50-60	20
60-70	15
70-above	8
<b>Total</b>	90

(i) Find the probability that a student obtained less than 20% in the mathematics test.

(ii) Find the probability that a student obtained marks 60 or above.

1.4.2 Solution:

1. Total no of student = 90

no of students who obtained marks less than 20% = 7

assume that  $P(A)$  is the probability of the students obtained less than 20% marks

$$P(A) = \frac{7}{90} \quad (1.4.1.1)$$

$$= 0.07 \quad (1.4.1.2)$$

2. no of the students obtained 60-70 marks = 15  
no of the student obtained 70 above marks = 8

$P(B)$  = probability of a student obtained 60 or above marks

$$p(B) = \frac{15 + 8}{90} \quad (1.4.2.1)$$

$$= 0.256 \quad (1.4.2.2)$$

### 1.5 Problem5

1.5.1 question:

1. To know the opinion of the students about the subject statistics, a survey of 200 students was conducted. The data is recorded in the following table.

Opinion	Number of students
like	135
dislike	65

Find the probability that a student chosen at random

(i) likes statistics,

(ii) does not like it.

### 1.5.2 Solution:

1. No of the total students participating the survey = 200  
students like the statics = 135  
 $P(A)$  = probability of student likes the statics

$$P(A) = \frac{135}{200} \quad (1.5.1.1)$$

$$= 0.675 \quad (1.5.1.2)$$

2. No of students do not like the statics = 65  
 $P(B)$  = probability of student does not like the statics

$$P(B) = \frac{65}{200} = 0.325 \quad (1.5.2.1)$$

### 1.6 Problem6

#### 1.6.1 question:

1. An organisation selected 2400 families at random and surveyed them to determine a relationship between income level and the number of vehicles in a family. The information gathered is listed in the table:  
??

Monthly income (in ₹)	vehicles per family			
	0	1	2	Above 2
Less than 7000	10	160	25	0
7000-10000	0	305	27	2
10000-13000	1	535	29	1
13000-16000	2	469	59	25
16000 or more	1	579	82	88

Suppose a family is chosen. Find the probability that the family chosen is

- (i) earning ₹10000 – ₹13000 per month and owning exactly 2 vehicles.
- (ii) earning ₹16000 or more per month and owning exactly 1 vehicle.
- (iii) earning less than ₹7000 per month and does not own any vehicle.
- (iv) earning ₹13000 – ₹16000 per month and owning more than 2 vehicles.
- (v) owning not more than 1 vehicle.

#### 1.6.2 Solution:

1. no of total families chosen for survey = 2400  
No of families owning 2 vehicles and earning of ₹10000 - ₹13000 per month = 1

$$P(A) = \frac{29}{2400} = 0.012 \quad (1.6.1.1)$$

2. No of families earning ₹16000 and more per month and owning exactly 1 vehicle = 579  
 $P(B)$  = probability of a family to have 1 vehicle with earning of ₹16000 and more

$$P(B) = \frac{579}{2400} \quad (1.6.2.1)$$

$$= 0.241 \quad (1.6.2.2)$$

3. No of families earning less than ₹7000 per month and owning exactly no vehicle = 10  
 $P(C)$  = probability of a family to have no vehicle with earning less than ₹7000

$$P(C) = \frac{10}{2400} \quad (1.6.3.1)$$

$$= 0.0042 \quad (1.6.3.2)$$

4. No of families earning ₹13000 to ₹16000 per month and owning more than 2 vehicle = 25  
 $P(D)$  = probability of a family to have more than 2 vehicles with earning ₹13000 to ₹16000 per month

$$P(D) = \frac{25}{2400} \quad (1.6.4.1)$$

$$= 0.0104 \quad (1.6.4.2)$$

5. No of families owning not more than 1 vehicle  
→

earning less than ₹7000 = 170

earning ₹7000 to ₹10000 = 305

earning ₹7000 to ₹10000 = 536

earning ₹7000 to ₹10000 = 471

earning ₹7000 to ₹10000 = 580

total no of families = 1892

$P(E)$  = probability of a family to have not more than 1 vehicle

$$P(E) = \frac{1892}{2400} \quad (1.6.5.1)$$

$$= 0.78833 \quad (1.6.5.2)$$

### 1.7 Problem7

#### 1.7.1 question:

1. Eleven bags of wheat flour, each marked 5 kg, actually contained the following weights of flour (in kg):

4.97 5.05 5.08 5.03 5.00 5.06 5.08 4.98 5.04 5.07 5.00

Find the probability that any of these bags chosen at random contains more than 5 kg of flour.

#### 1.7.2 Solution:

1. No of bags having weight more than g Kg = 7  
total no of bags = 11

$$P(A) = \frac{7}{11} \quad (1.7.1.1)$$

$$= 0.636 \quad (1.7.1.2)$$

### 1.8 Problem8

#### 1.8.1 question:

1. Prepare a frequency distribution table, regarding the concentration of sulphur dioxide in the air in parts per million of a certain city for 30 days.

0.03 0.08 0.08 0.09 0.04 0.17  
0.16 0.05 0.02 0.06 0.18 0.20  
0.11 0.08 0.12 0.13 0.22 0.07  
0.08 0.01 0.10 0.06 0.09 0.18  
0.11 0.07 0.05 0.07 0.01 10.04

Using this table, find the probability of the concentration of sulphur dioxide in the interval 0.12 - 0.16 on any of these days.

#### 1.8.2 Solution: =

1. P(A) be the probability of concentration of sulphur

$$p(A) = \frac{1 + 1 + 1}{30} \quad (1.8.1.1)$$

$$= 0.1 \quad (1.8.1.2)$$

## 2 STATICS

### 2.1 Problem1

#### 2.1.1 question:

1. A survey was conducted by a group of students as a part of their environment awareness programme, in which they collected the following data regarding the number of plants in 20

concentration of sulphur	friquency
0.01	2
0.02	1
0.03	1
0.04	2
0.05	2
0.06	2
0.07	3
0.08	4
0.09	2
0.10	1
0.11	2
0.12	1
0.13	1
0.16	1
0.17	1
0.18	2
0.20	1
0.22	1

TABLE 1.8.1: This is a table template

houses in a locality. Find the mean number of plants per house.

Number of plants	0-2	2-4	4-6
Number of houses	1	2	1
Number of plants	6-8	0-10	10-12
Number of houses	5	6	2

#### 2.1.2 Solution:

No of mangoes	No of boxes	midpoint	f.x
50-52	15	51	765
53-55	110	54	5490
56-58	135	57	7695
59-61	115	60	6900
62-64	25	63	1575
	$\sum f=400$		$\sum f.x=22425$

TABLE 2.1.1: To construct  $\angle QAB$

TABLE 2.1.1: frequency distribution table

Daily wages	500-520	520-540	540-560
No of workers	12	14	8
Daily wages	560-580	580-600	
No of workers	6	10	

1.

$$\sum f = 17 \quad (2.1.1.1)$$

$$\sum f.x = 123 \quad (2.1.1.2)$$

$$\text{Mean} = \frac{\sum f.x}{\sum f} \quad (2.1.1.3)$$

$$= \frac{123}{17} \quad (2.1.1.4)$$

## 2.2 Problem2

### 2.2.1 question:

1. Consider the following distribution of daily wages of 50 workers of a factory. Find the mean daily wages of the workers of the factory by using an appropriate method.

### 2.2.2 Solution:

Daily wages	No of workers	midpoint	f.x
500-520	12	510	6120
520-540	14	530	7420
540-560	8	550	4400
560-580	6	570	3420
580-600	10	590	5900
	$\sum f = 50$		$\sum f.x = 27260$

TABLE 2.2.1: frequency distribution table2

1.

$$\sum f = 50 \quad (2.2.1.1)$$

$$\sum f.x = 27260 \quad (2.2.1.2)$$

$$\text{Mean} = \frac{\sum f.x}{\sum f} \quad (2.2.1.3)$$

$$= \frac{27260}{50} \quad (2.2.1.4)$$

$$= 545.2 \quad (2.2.1.5)$$

pocket allowance	11-13	13-15	15-17	17-19
Number of children	7	6	9	13
pocket allowance	19-21	21-23	23-25	
Number of children	f	5	4	

## 2.3 Problem3

### 2.3.1 question:

1. The following distribution shows the daily pocket allowance of children of a locality. The mean pocket allowance is Rs 18. Find the missing frequency f.

### 2.3.2 Solution:

pocket allowances	No of children	midpoint	f.x
11-13	7	12	84
13-15	6	14	84
15-17	9	16	144
17-19	13	18	234
19-21	f	20	20f
21-23	5	22	110
23-25	4	24	96
	$\sum f = 44 + f$		$\sum f.x = 752 + 20f$

TABLE 2.3.1: frequency distribution table3

1.

$$\sum f = 50 + f \quad (2.3.1.1)$$

$$\sum f.x = 752 + 20f \quad (2.3.1.2)$$

$$\text{Mean} = \frac{\sum f.x}{\sum f} \quad (2.3.1.3)$$

$$18 = \frac{752 + 20f}{44 + f} \quad (2.3.1.4)$$

$$f = 20 \quad (2.3.1.5)$$

## 2.4 Problem4

### 2.4.1 question:

1. Thirty women were examined in a hospital by a doctor and the number of heartbeats per minute were recorded and summarised as follows. Find the mean heartbeats per minute for these women, choosing a suitable method.

No. of heartbeats	65-68	68-71	71-74	74-77
No. of women	2	4	3	8
No. of heartbeats	77-80	80-83	83-86	
No. of women	7	4	2	

No of heartbeats	No of women	midpoint	f.x
65-68	2	66.5	133
68-71	4	69.5	278
71-74	3	72.5	217.5
74-77	8	75.5	604
77-80	7	78.5	549.5
80-83	4	81.5	326
83-86	2	84.5	169
	$\sum f=30$		$\sum f.x=2277$

TABLE 2.4.1: frequency distribution table4

2.4.2 Solution:

1.

$$\sum f = 30 \quad (2.4.1.1)$$

$$\sum f.x = 2277 \quad (2.4.1.2)$$

$$\text{Mean} = \frac{\sum f.x}{\sum f} \quad (2.4.1.3)$$

$$= \frac{2277}{30} \quad (2.4.1.4)$$

$$= 75.9 \quad (2.4.1.5)$$

## 2.5 Problem5

2.5.1 question:

1. In a retail market, fruit vendors were selling mangoes kept in packing boxes. These boxes contained varying number of mangoes. The following was the distribution of mangoes according to the number of boxes.

No of mangoes	50-52	53-55	56-58
No of boxes	15	110	135
No of mangoes	59-61	62-64	
No of boxes	115	25	

Find the mean number of mangoes kept in a packing box. Which method of finding the mean did you choose?

2.5.2 Solution:

No of mangoes	No of boxes	midpoint	f.x
50-52	15	51	765
53-55	110	54	5940
56-58	135	57	7695
59-61	115	60	6900
62-64	25	63	1575
	$\sum f=400$		$\sum f.x=22425$

TABLE 2.5.1: frequency distribution table5

1.

$$\sum f = 400 \quad (2.5.1.1)$$

$$\sum f.x = 22425 \quad (2.5.1.2)$$

$$\text{Mean} = \frac{\sum f.x}{\sum f} \quad (2.5.1.3)$$

$$= \frac{22425}{400} \quad (2.5.1.4)$$

$$= 56.06 \quad (2.5.1.5)$$

## 2.6 Problem6

2.6.1 question:

1. The table below shows the daily expenditure on food of 25 households in a locality. Find the

Daily expenditure	100-150	150-200	200-250
No of households	4	5	12
Daily expenditure	250-300	300-350	
No of households	2	2	

mean daily expenditure on food by a suitable method.

2.6.2 Solution:

daily expenditure	No of households	midpoint	f.x	concentration of $SO_2$	frequency	midpoint	f.x
100-150	4	125	500	0.00-0.04	4	0.02	0.08
150-200	5	175	875	0.04-0.08	9	0.06	0.36
200-250	12	225	2700	0.08-0.12	9	0.10	0.90
250-300	2	275	550	0.12-0.16	2	0.14	0.28
300-350	2	325	650	0.16-0.20	4	0.18	0.72
	$\sum f=25$		$\sum f.x=5275$	0.20-0.24	2	0.22	0.44
					$\sum f=30$		$\sum f.x=2.78$

TABLE 2.6.1: frequency distribution table6

TABLE 2.7.1: frequency distribution table7

1.

$$\sum f = 25 \quad (2.6.1.1)$$

$$\sum f.x = 5275 \quad (2.6.1.2)$$

$$\text{Mean} = \frac{\sum f.x}{\sum f} \quad (2.6.1.3)$$

$$= \frac{5275}{25} \quad (2.6.1.4)$$

$$= 211 \quad (2.6.1.5)$$

2.8 Problem8

2.8.1 question:

1. A class teacher has the following absentee record of 40 students of a class for the whole term. Find the mean number of days a student was absent.

2.7 Problem7

2.7.1 question:

1. To find out the concentration of  $SO_2$  in the air (in parts per million, i.e., ppm), the data was collected for 30 localities in a certain city and is presented below:

Concentration $SO_2$ (in ppm)	0.00-0.04	0.04-0.08	0.08-0.12
Frequency	4	9	9
Concentration $SO_2$ (in ppm)	0.12-0.16	0.16-0.20	0.20-0.24
Frequency	2	4	2

Find the mean concentration of  $SO_2$  in the air.

2.7.2 Solution:

1.

$$\sum f = 30 \quad (2.7.1.1)$$

$$\sum f.x = 2.78 \quad (2.7.1.2)$$

$$\text{Mean} = \frac{\sum f.x}{\sum f} \quad (2.7.1.3)$$

$$= \frac{2.78}{30} \quad (2.7.1.4)$$

$$= 0.092 \quad (2.7.1.5)$$

No of days	0-6	6-10	10-14	14-20
No of students	11	10	7	4
No of days	20-28	28-38	38-40	
No of students	4	3	1	

2.8.2 Solution:

No of days	No of students	midpoint	f.x
0-6	11	3	33
6-10	10	8	80
10-14	7	12	84
14-20	4	17	68
20-28	4	24	96
28-38	3	33	99
38-40	1	39	39
	$\sum f=40$		$\sum f.x=499$

TABLE 2.8.1: frequency distribution table8

1.

$$\sum f = 40 \quad (2.8.1.1)$$

$$\sum f.x = 499 \quad (2.8.1.2)$$

$$\text{Mean} = \frac{\sum f.x}{\sum f} \quad (2.8.1.3)$$

$$= \frac{499}{40} \quad (2.8.1.4)$$

$$= 12 \quad (2.8.1.5)$$

## 2.9 Problem9

### 2.9.1 question:

1. The following table gives the literacy rate (in percentage) of 35 cities. Find the mean literacy rate.

literacy(in percentage)	45-55	55-65	65-75
Number of cities	3	10	11
literacy(in percentage)	75-85	85-95	
Number of cities	8	3	

### 2.9.2 Solution:

literacy in percentage	No of cities	midpoint	f.x
45-55	3	50	150
55-65	10	60	600
65-75	11	70	770
75-85	8	80	640
85-95	3	90	270
	$\sum f=35$		$\sum f.x=2430$

TABLE 2.9.1: friquency distribution table9

1.

$$\sum f = 35 \quad (2.9.1.1)$$

$$\sum f.x = 2430 \quad (2.9.1.2)$$

$$\text{Mean} = \frac{\sum f.x}{\sum f} \quad (2.9.1.3)$$

$$= \frac{2430}{35} \quad (2.9.1.4)$$

$$= 69.42 \quad (2.9.1.5)$$