Assignment 2
AI1110: Probability and Random Variables

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5 [9^{th} NCERT Probability Exercise 15.1]:
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

TABLE I

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.

Solution: Let X be the random variable denoting the number of vehicles and Y be the income.

1) Total number of families is sum of values in all cells, which is = 2400

2)
$$\Pr\left(X = 2, 10000 < Y < 13000\right) = \frac{29}{2400} \tag{2.1}$$
$$= 0.012 \tag{2.2}$$

3)
$$\Pr\left(X = 1, Y > 16000\right) = \frac{579}{2400} \tag{3.1}$$
$$= 0.241 \tag{3.2}$$

4)
$$\Pr\left(X = 0, Y < 7000\right) = \frac{10}{2400} \tag{4.1}$$
$$= 0.0042 \tag{4.2}$$

5)
$$\Pr\left(X > 2, 13000 < Y < 16000\right) = \frac{25}{2400} \tag{5.1}$$
$$= 0.0104 \tag{5.2}$$

6) For this case, the number of families is given by the sum of columns 0 and 1 in Table I. Hence,
$$\Pr\left(X < 2\right) = \frac{2062}{2400} \tag{6.1}$$
$$= 0.859 \tag{6.2}$$