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## CH-4 Probability

CSCE-5310 Section-400

Methods in Empirical Analysis

Uday Bhaskar Valapadavu

11696364

### Solution:

i) Probability of a randomly selected patient being transported by helicopter:

Total patients in the study = 47,637 (Helicopter)  
+ 111,874 (ground)

$$= 159,511$$

This is a case of using the relative frequency approach probability.

PC transported by helicopter = (Number of patients transported by helicopter) / (Total patients)

$$P(\text{transported by helicopter}) = \frac{47,637}{159,511} \\ \approx 0.2986439 \\ \approx 0.299$$

2.) Probability of all 5 randomly selected patients (without replacement) being transported by helicopter:

→ This is a case of the multiplication rule for dependent events, as the selections are made without replacements.

→ However, since the sample size (5) is less than 5% population size (159,511), we can treat the events as independent and use the multiplication rule for independent events.

$P(\text{all 5 transported by helicopter}) =$

$$P(1^{\text{st}} \text{ is helicopter}) \times P(2^{\text{nd}} \text{ is helicopter}) \\ \times P(3^{\text{rd}} \text{ is helicopter}) \times P(4^{\text{th}} \text{ is helicopter}) \\ \times P(5^{\text{th}} \text{ is helicopter})$$

$\rightarrow P(\text{all 5 transported by helicopter}) =$

$$\text{by step method} = (0.299)^5 \\ = 0.0023897 \\ \approx 0.00238$$

3.7 Probability of none of the 40 randomly selected patients (without replacement) transported by helicopter leaving against medical advice:

$\rightarrow$  Among the 47,637 patients transported by helicopter, 188 left against medical advice, and 47,449 did not.

→ This is a case of the multiplication rule for dependent events, as the selections are made without replacement.

→ However, since the sample size (40) is less than 5% of the population size (47,637) we can treat the events as independent and use the multiplication rule for independent events.

$$\begin{aligned} \rightarrow p(\text{none of the 40 left against medical advice}) &= p(1\text{st did not leave}) \times \\ &\quad p(2\text{nd did not leave}) \times \\ &\quad p(40\text{th did not leave}) \\ \rightarrow p(\text{did not leave against medical advice}) &= \\ &= 47449 / 47637 \\ &= 0.9960534 \\ &\approx 0.996 \end{aligned}$$

$\rightarrow P(\text{none of the } 40 \text{ left against medical advice}) = (0.996)^{40}$

$$= 0.851870$$

$$\approx 0.852$$

∴ The probability that a randomly selected patient was transported by helicopter is about 0.299,

$\rightarrow$  The probability that all 5 randomly selected patients were transported by helicopter is about 0.00238

$\rightarrow$  The probability that none of the ~~40~~ 40 randomly selected patients transported by helicopter left against medical advice is about 0.85<sup>2</sup>