UE19CS203 – STATISTICS FOR DATA SCIENCE

Unit-1 - Introduction to Data Science

QUESTION BANK - SOLVED

Probability

Exercises for Section 2.1   **[Text Book Exercise– Pg. No. [60 – 62]]**

1. A commuter passes through three traffic lights on the way to work. Each light is either red,green or yellow. An experiment consists of observing the colors of the three lights.
a. List the 27 outcomes in the sample space.
b. Let *A* be the event that all the parts fall into the same category. List the outcomes in *A*.
c. Let *B* be the event that there is one part in each category. List the outcomes in *B*.
d. Let *C* be the event that at least two parts are conforming.List the outcomes in *C*.
e. List the outcomes in *A* ∩ *C*.
f. List the outcomes in *A* ∪ *B*.
g. List the outcomes in *A* ∩ *Cc*.
h. List the outcomes in *Ac* ∩ *C*.
i. Are events *A* and *C* mutually exclusive? Explain.
j. Are events *B* and *C* mutually exclusive? Explain.
[Text Book Exercise – Section 2.1 – Q. No.4 – Pg. No. 60]

Solution:

(a) The outcomes are the 27 different strings of 3 chosen from red, yellow and green. These are {RRR, RRY, RRG, RYR, RYY, RYG, RGR, RGY, RGG, YRR, YRY, YRG, YYR, YYY, YYG, YGR, YGY, YGG, GRR, GRY, GRG, GYR, GYY, GYG, GGR, GGY, GGG}.

(b) A = {RRR, YYY, GGG}

(c) B = {RYG, RGY, YRG, YGR, GRY, GYR}

(d) C = {RGG, GRG, GGR, YGG, GYG, GGY, GGG}

(e) The only outcome common to A and C is GGG. Therefore A∩C = {GGG}.

(f) The set A∪B contains the outcomes that are either in A, in B, or in both. Therefore A∪B = {RRR, YYY, GGG, RYG, RGY, YRG, YGR, GRY, GYR}.

(g) C contains the outcomes that are not in C. A∩C c contains the outcomes that are in A but not in C. Therefore A∩C c = {RRR, YYY}.

(h) A c contains the outcomes that are not in A. A c ∩C contains the outcomes that are in C but not in A. Therefore A c ∩C = {RGG, GRG, GGR, YGG, GYG, GGY}.

(i) No. They both contain the outcome GGG.

(j) Yes. They have no outcomes in common

2. Among the cast aluminum parts manufactured on a certain day, 80% were flawless, 15% had only minor flaws, and 5% had major flaws. Find the probability that a randomly chosen part
a. has a flaw (major or minor).
b. has no major flaw.

[Text Book Exercise – Section 2.1 – Q. No.9 – Pg. No. 61]

Solution:

(a) The events of having a major flaw and of having only minor flaws are mutually exclusive. Therefore P(major flaw or minor flaw) = P(major flaw) +P(only minor flaws) = 0.15+0.05 = 0.20.

(b) P(no major flaw) = 1−P(major flaw) = 1−0.05 = 0.95.

3. Let S be the event that a randomly selected college student has taken a statistics course, and let C be the event that the same student has taken a chemistry course. Suppose $P(S) = 0.4$, $P(C) = 0.3$, and $P(S \cap C) = 0.2$.
a. Find the probability that a student has taken statistics,chemistry, or both.
b. Find the probability that a student has taken neither statistics nor chemistry.
c. Find the probability that a student has taken statistics but not chemistry.
[Text Book Exercise – Section 2.1 – Q. No.13 – Pg. No. 61]

Solution:
(a) P(S∪C) = P(S) +P(C)−P(S∩C) = 0.4+0.3−0.2 = 0.5

(b) P(S c ∩C c) = 1−P(S∪C) = 1−0.5 = 0.5.

(c) We need to find $P(S \cap C^c)$.

Now $P(S) = P(S \cap C) + P(S \cap C^c)$ (this can be seen from a Venn diagram).

Now $P(S \cap C) = P(S) + P(C) - P(S \cup C) = 0.4 + 0.3 - 0.5 = 0.2$ Since $P(S) = 0.4$ and $P(S \cap C) = 0.2$, $P(S \cap C^c) = 0.2$