ASSIGNMENT – 2

Name – Hiyansh Sharma   Roll no – 2401730263   Course – BTech CSE AI ML   Section – A

Q.1 A jar contains 5 red and 7 blue marbles. Two marbles are drawn randomly one after the other without replacement. What is the probability that the second marble is red, given that the first one was blue?

```
def solve_q1_marbles():
    print("--- Q.1: Conditional Probability (Marbles) ---")
    red_marbles = np.array([5])
    blue_marbles = np.array([7])
    total_marbles = red_marbles + blue_marbles
    blue_marbles_after_draw_1 = blue_marbles - 1
    total_marbles_after_draw_1 = total_marbles - 1
    red_marbles_after_draw_1 = red_marble
    p_r2_given_b1 = red_marbles_after_draw_1 / total_marbles_after_draw_1
    print(f"Red marbles remaining: {red_marbles_after_draw_1[0]}")
    print(f"Total marbles remaining: {total_marbles_after_draw_1[0]}")
    print(f"Probability P(R2 | B1) = {p_r2_given_b1[0]:.4f}")
    return p_r2_given_b1[0]
```

Solution-

Red marbles remaining: 5

Total marbles remaining: 11

Probability P(R2 | B1) = 0.4545

Q2. According to the industry reports, the blood sample 95% of the people with a particular disease yield positive results. But 2% of the people without the disease also give positive results (false positive). 1% of the total population is infected by the disease. Determine the probability that a person chosen randomly from the population will have disease given that the blood sample of the person tests positive?

```
def solve_bayes_theorem(prior_disease_prob):
    P_T_given_D = np.array([0.95])
    P_T_given_notD = np.array([0.02])

    P_D = np.array([prior_disease_prob])
    P_notD = 1 - P_D

    p_t = (P_T_given_D * P_D) + (P_T_given_notD * P_notD)

    p_d_given_t = (P_T_given_D * P_D) / p_t

    return p_d_given_t[0]
```

ASSIGNMENT – 2

Name – Hiyansh Sharma   Roll no – 2401730263   Course – BTech CSE AI ML   Section – A

```
def solve_q2_bayes_initial():
    print("\n--- Q.2: Bayes' Theorem (Population Prior) ---")

    prior_prob = 0.01

    p_d_given_t = solve_bayes_theorem(prior_prob)

    print(f"Population Prior P(D) = {prior_prob}")
    print(f"Revised Probability P(D | T) = {p_d_given_t:.4f}")
    return p_d_given_t
```

Solution-

Population Prior P(D) = 0.01

Revised Probability P(D | T) = 0.3242

Q3. A patient from the population given above walks into the clinic of a doctor with some symptoms of the disease. After examining the patient and without checking the blood test report, the doctor gives his opinion that there are 30% chances that the patient is suffering from the disease. How should revise his opinion after checking the blood report

```
def solve_q3_bayes_revised():
    print("\n--- Q.3: Revised Bayes' Theorem (Doctor's Prior) ---")

    prior_prob = 0.30

    p_d_given_t = solve_bayes_theorem(prior_prob)

    print(f"Doctor's Prior P(D) = {prior_prob}")
    print(f"Revised Probability P(D | T) = {p_d_given_t:.4f}")
    return p_d_given_t
```

Solution-

Doctor's Prior P(D) = 0.3

Revised Probability P(D | T) = 0.9532

ASSIGNMENT – 2

Name – Hiyansh Sharma   Roll no – 2401730263   Course – BTech CSE AI ML   Section – A

Q4. In a group of 50 students, 30 study Physics, 25 study Chemistry, and 15 study both. Draw a Venn diagram to represent this and find the probability that a randomly selected student studies only Physics.

```
def solve_q4_q5_venn_diagram():
    print("\n--- Q.4 & Q.5: Set Probability (Venn Diagram) ---")

    total_students = np.array([50])
    students_physics = np.array([30])
    students_chemistry = np.array([25])
    students_both = np.array([15])

    students_only_physics = students_physics - students_both

    p_only_physics = students_only_physics / total_students

    print(f"Total Students: {total_students[0]}")
    print(f"Students studying only Physics: {students_only_physics[0]}")
    print(f"Probability P(Only Physics) = {p_only_physics[0]:.4f}")
    return p_only_physics[0]
```

Solution-
Total Students: 50
Students studying only Physics: 15
Probability P(Only Physics) = 0.3000

Q5. In a group of 50 students, 30 study Physics, 25 study Chemistry, and 15 study both. Draw a Venn diagram to represent this and find the probability that a randomly selected student studies only
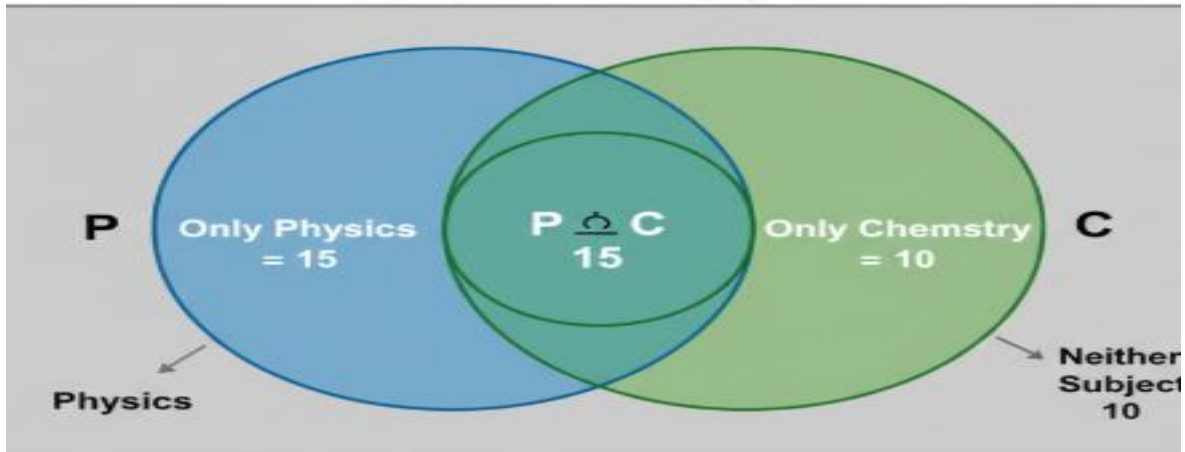
Name – Hiyansh Sharma   Roll no – 2401730263   Course – BTech CSE AI ML   Section – A

Physics.

Venn Diagram Analysis (Q4 & Q5)

Total Students (S) = 50

P   Only Physics = 15   P ⌒ C 15   Only Chemstry = 10   C

Physics

Neither Subject 10

Probability (Only Phyics: 15/50 = 0.3