A research study wants to analyze the weight distribution of a sample of individuals to assess their health and body composition.

Data: Let's consider the weights (in kilograms) of a sample of 100 individuals: Weights:

55, 60, 62, 65, 68, 70, 72, 75, 78, 80, 82, 85, 88, 90, 92, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170, 175, 180, 185, 190, 195, 200, 205, 210, 215, 220, 225, 230, 235, 240, 245, 250, 255, 260, 265, 270, 275, 280, 285, 290, 295, 300, 305, 310, 315, 320, 325, 330, 335, 340, 345, 350, 355, 360, 365, 370, 375, 380, 385, 390, 395, 400, 405, 410, 415, 420, 425, 430, 435, 440, 445, 450, 455, 460, 465, 470, 475, 480, 485, 490, 495, 500, 505, 510, 515

Questions:

1. Quartiles: Calculate the first quartile (Q1), median (Q2), and third quartile(Q3) of the weight distribution.
2. Percentiles: Calculate the 15th percentile, 50th percentile, and 85thpercentile of the weight distribution.
3. Interpretation: Based on the quartiles and percentiles, what can be inferredabout the weight distribution of the individuals?

**Data set**

55, 60, 62, 65, 68, 70, 72, 75, 78, 80, 82, 85, 88, 90, 92, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170, 175, 180, 185, 190, 195, 200, 205, 210, 215, 220, 225, 230, 235, 240, 245, 250, 255, 260, 265, 270, 275, 280, 285, 290, 295, 300, 305, 310, 315, 320, 325, 330, 335, 340, 345, 350, 355, 360, 365, 370, 375, 380, 385, 390, 395, 400, 405, 410, 415, 420, 425, 430, 435, 440, 445, 450, 455, 460, 465, 470, 475, 480, 485, 490, 495, 500, 505, 510, 515

**Quartiles (Q1, Q2, Q3)**

**For a sample of size n=100 the rank *r* of the *p*-th percentile is:**

**If *r* is an integer, the percentile is exactly the observation at that rank. If *r* is not an integer, we interpolate linearly between the two surrounding observations:**

**Where  denotes the i‑th sorted observation.**

**Quartiles:**

**Q1(25%)**

**P = 25**

**Rank r = 0.25 x 101 = 25.25**

**Calculation:**

**25th + 0.25 x (26th -25th)**

**Result:**

**140 + 0.25 x (145 – 140) = 142.5 Kg**

**Median (Q2, 50%)**

**P = 50**

**Rank r = 0.50 x 101 = 50.50**

**Calculation:**

**50th + 0.50 x (51st -50th)**

**Result:**

**265 + 0.50 x (270 – 265) = 267.5 Kg**

**Q3(75%)**

**P = 75**

**Rank r = 0.75 x 101 = 75.75**

**Calculation:**

**75th + 0.75 x (76th – 75th)**

**Result**

**400 + 0.75 x (405-400) = 402.5 Kg**

**So:**

* **Q1 = 142.5 kg (the 25 % quantile)**
* **Median = 267.5 kg (the 50 % quantile)**
* **Q3 = 402.5 kg (the 75 % quantile)**

**The inter‑quartile range**

**(IQR) is**

**Q3–Q1 = 402.5 – 142.5 = 260 kg**

**Percentiles (15th, 50th, 85th)**

**Percentile = 15th**

**P = 15**

**Rank r = 0.15 x 101 = 15.15**

**Calculation: 15th + 0.15 x (16th – 15th)**

**Result: 92 + 0.15 x (95-92) = 92.45 Kg**

**Percentile = 50th**

**P = 50**

**Rank r = 0.50 x 101 = 50.50**

**Calculation: 50th + 0.50 x (51st -50th)**

**Result: 265 + 0.50 x (270 – 265) = 265.5 Kg**

**Percentile = 85th**

**P = 85**

**Rank r = 0.85 x 101 = 85.85**

**Calculation = 85th + 0.85 x (86th – 85th)**

**Result = 440 + 0.85 x (445 – 440) = 444.25Kg**

**Interpretation of the distribution**

**Median = 267.5 kg**

**it shows:**

**Half the participants weigh ≤ 267.5 kg, half > 267.5 kg.**

**meaning for the study:**

**The central tendency is far above the typical adult weight range; most participants are overweight/obese.**

**Q1 = 142.5 kg**

**it shows:**

**25 % of participants are lighter than 142.5 kg.**

**meaning for the study**

**The lower end of the sample includes normal‑weight or slightly overweight individuals.**

**Q3 = 402.5 kg**

**it shows:**

**25 % of participants are heavier than 402.5 kg.**

**meaning for the study:**

**The upper end represents severely obese individuals.**

**IQR = 260 kg**

**it shows:**

**The middle 50 % of the sample spans 260 kg.**

**meaning for the study:**

**the sample is not tightly clustered around a single weight.**

**15th percentile ≈ 92 kg**

**it shows:**

**15 % of participants weigh < 92 kg.**

**meaning for the study:**

**Very few participants are under‑weight relative to healthy BMI ranges.**

**85th percentile ≈ 444 kg**

**it shows:**

**15 % of participants weigh > 444 kg.**

**meaning for the study:**

**A substantial minority fall into a very high‑weight (obese) bracket.**