Case Study.
Julia is interested in programming, so she took two programming courses in R and Python. Her achievement was excellent, but she is curious to compare her performances. In the R programming course, she scored 125 where the mean and the standard deviation are 80 and 18. In the Python programming course, she scored 92 where the mean and the standard deviation are 72 and 10. Assume that all scores are normally distributed.

- What are the z-score in each programming course? Can you interpret them?

Z-score in the R programming course = $\frac{X-\mu}{\sigma} = \frac{125-80}{18} = \frac{45}{18} = 2.5$
Julia's score is 2.5 standard deviation unit above the mean in the R programming course.

Z-score in the Python programming course = $\frac{X-\mu}{\sigma} = \frac{92-72}{10} = \frac{20}{10} = 2$
Julia's score is 2 standard deviation unit above the mean in the Python programming course.

- What is the percentage of students who did better than Julia in the Python programming course?

0.5 - 0.4772 = 0.0228. There are 2.28% of students who did better than Julia in the Python programming course.

- What course did Julia showed a better achievement relative to her classmates?

R programming course because she has a higher z-score.

- Say Ihnwhi also took the same R programming course, and his z-score is -0.25.
  - What would be Ihnwhi's raw score?

Let's denote Ihnwhi's raw score as x_{ihnwhi}

$$-0.25 = \frac{x_{ihnwhi} - 80}{18}$$

$$-0.25 \times 18 = x_{ihnwhi} - 80$$

$$x_{ihnwhi} = -0.25 \times 18 + 80 = 75.5$$

Therefore, Ihnwhi's raw score is 75.5.

- What is the percentage of students who did worse than Ihnwhi?

40.13% (Can you find 0.4013 from the z-table?)

- What is the percentage of students who scored between Julia and Ihnwhi?

0.9938 - 0.4013 = 0.5925. Therefore, there are 59.25% of students who scored between Julia and Ihnwhi.