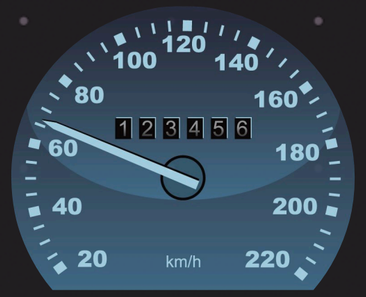
Statistics



Descriptive statistics

Summarise data

Central tendency, variability

1. “You are driving at 65 km/h”
2. “You will (most likely) reach destination in 30 mins”

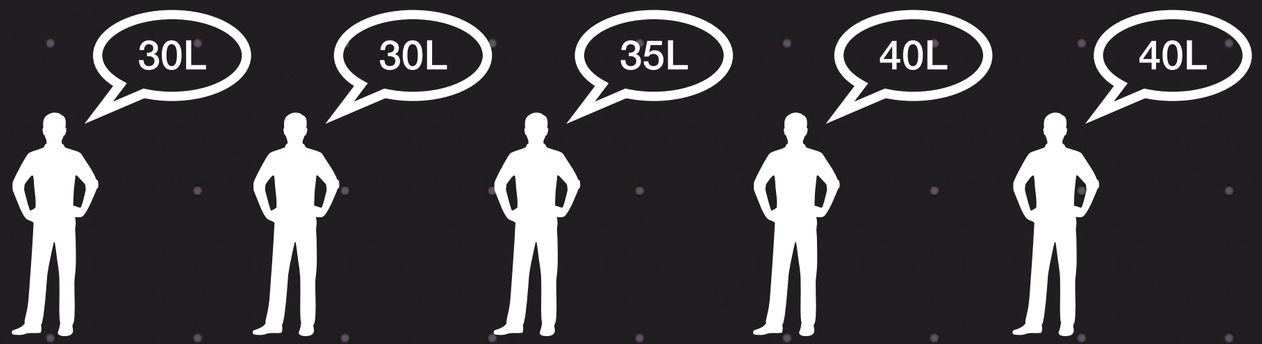
Inferential statistics

Drawing conclusions from observations

Confidence interval, hypothesis test, regression

1. “Vote share of candidate A was 70%”
2. “Our exit poll says candidate A will have 70% vote share”

Glassdoor/levels.fyi Salary for Data Scientist at Google



"Outlier"

We shall formalise this

Mean = $\frac{(30 + 30 + 35 + 40 + 40)}{5} = 35L$

Another word for mean is "Average"

New Mean = $\frac{30 + 30 + 35 + 40 + 40 + 300}{6} = 79L$

Crucial observation: Median is more robust to outliers

Median = $35L$

Central value (if unique)

$N = 5$, odd

New Median = $37.5L$

Average of 2 central values

$\frac{35 + 40}{2}$

$N = 6$, even

Median

10, 20, 30, 40, 50, 60, 70 — Middle number: 40; Median = 40

10, 20, 30, 40, 50, 60, 70, 80 — Two middle numbers: 40, 50; Median = (40 + 50)/2 = 45

Quiz There are 4 people whose average age is 24.

We know the age of three people: 20, 22, and 28.

What is the median age of these 4 people?

$$\frac{20 + 22 + 28 + x}{4} = 24$$

$$x = 4 * 24 - (20 + 22 + 28)$$

$$x = 26$$

$$20,\ 22,\ 26,\ 28$$

$$\textbf{Median} = \frac{22 + 26}{2} = 24$$

Mode

90, 90, 90, 80, 90, 70, 95, 90

Mode = 90

Mode is the most frequently occurring number, if such a number exists

2, 2, 3, 3, 4

We call this bi-modal with 2 and 3 as the modes

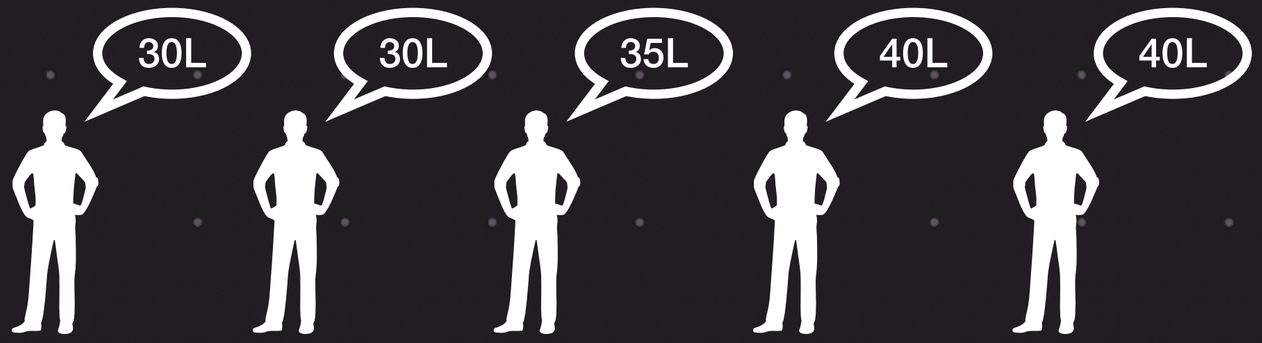
Range

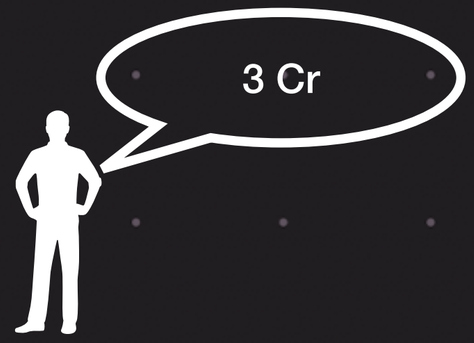
Suppose a cricketer has scored as follows

20, 25, 60, 100

We say the range = 100 - 20 = 80

Consider again the example of salaries



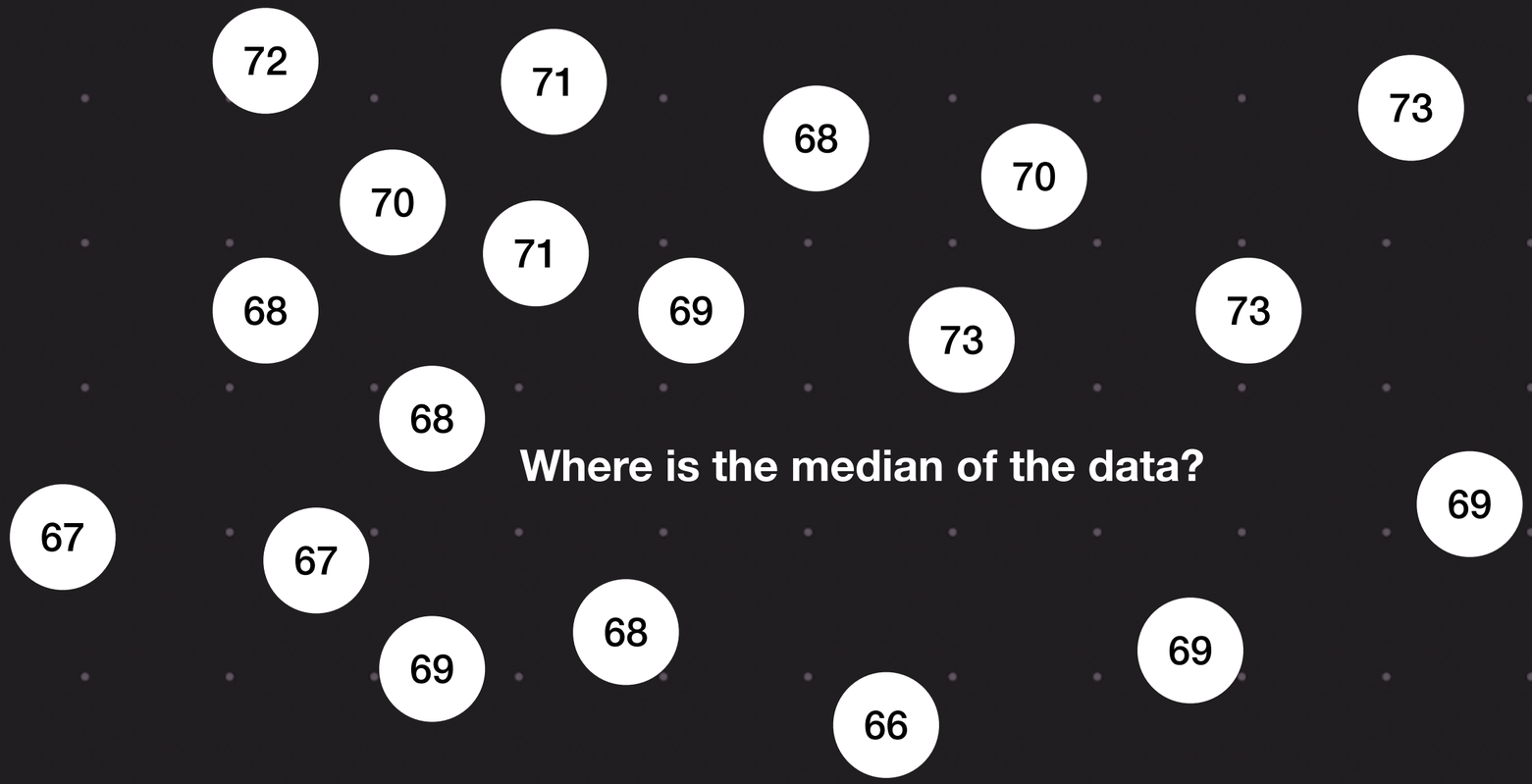


Here range = 300 - 30 = 270 L

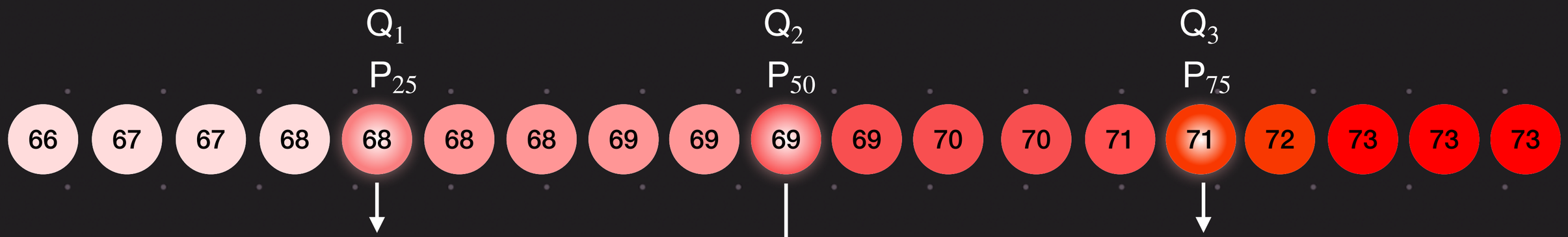
Sometimes, simply giving range may not make sense

Percentiles, Quartiles, Inter Quartile range (IQR)

Sort the data!



Percentiles, Quartiles, Inter Quartile range (IQR)



What is the median of the first half?

What fraction of data is less that this? $25\,\%$

Another name for this is 25^{th} **percentile -** P_{25}

Where is the median of the data?

What fraction of data is less that this? $50\,\%$

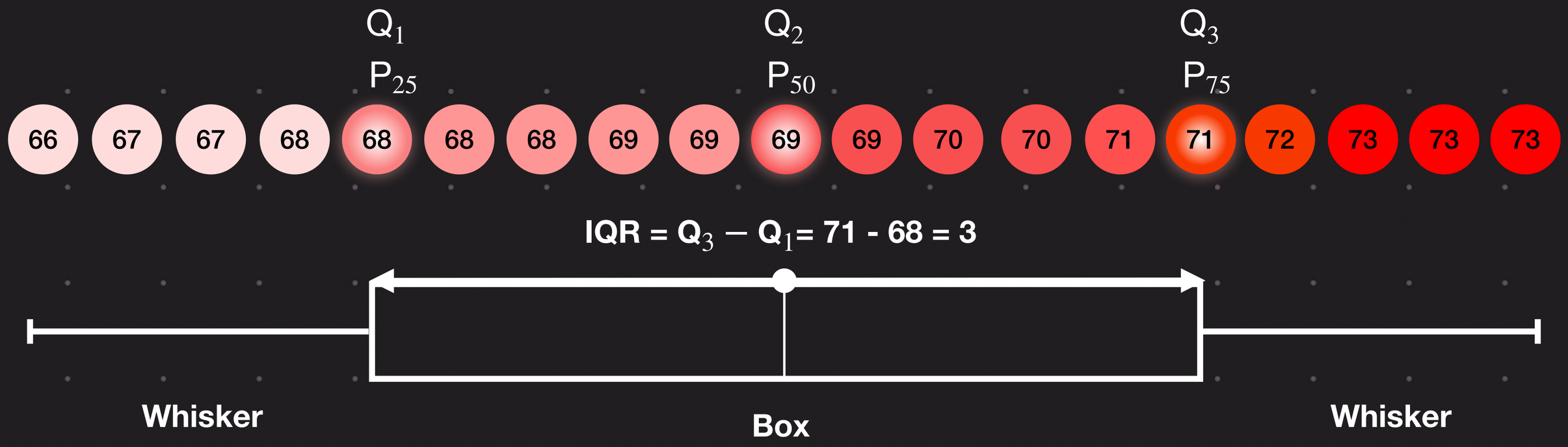
Another name for this is 50^{th} **percentile -** P_{50}

What is the median of the second half?

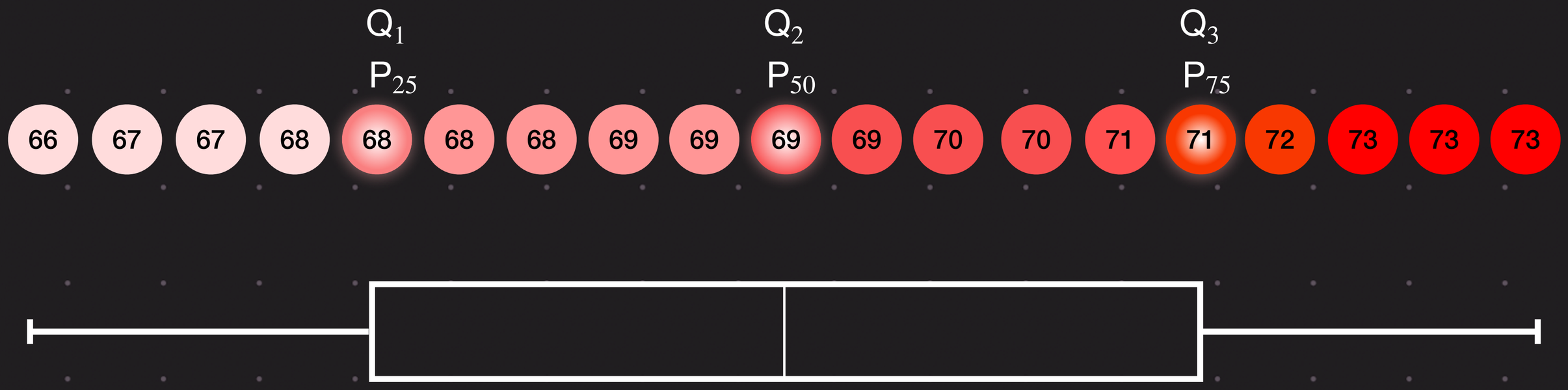
What fraction of data is less that this? $75\,\%$

Another name for this is 75^{th} **percentile -** P_{75}

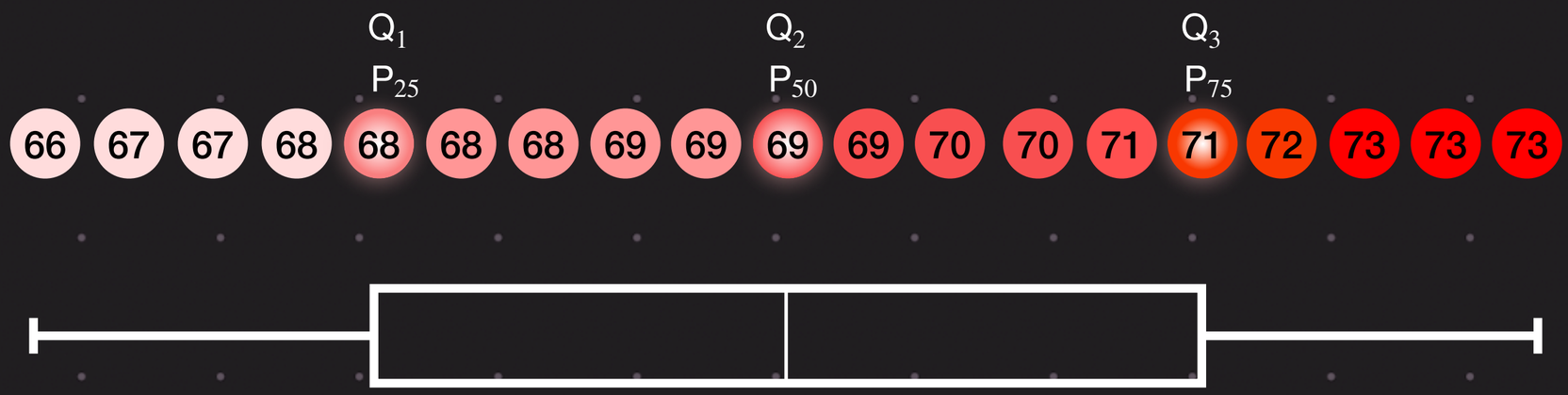
Percentiles, Quartiles, Inter Quartile range (IQR)



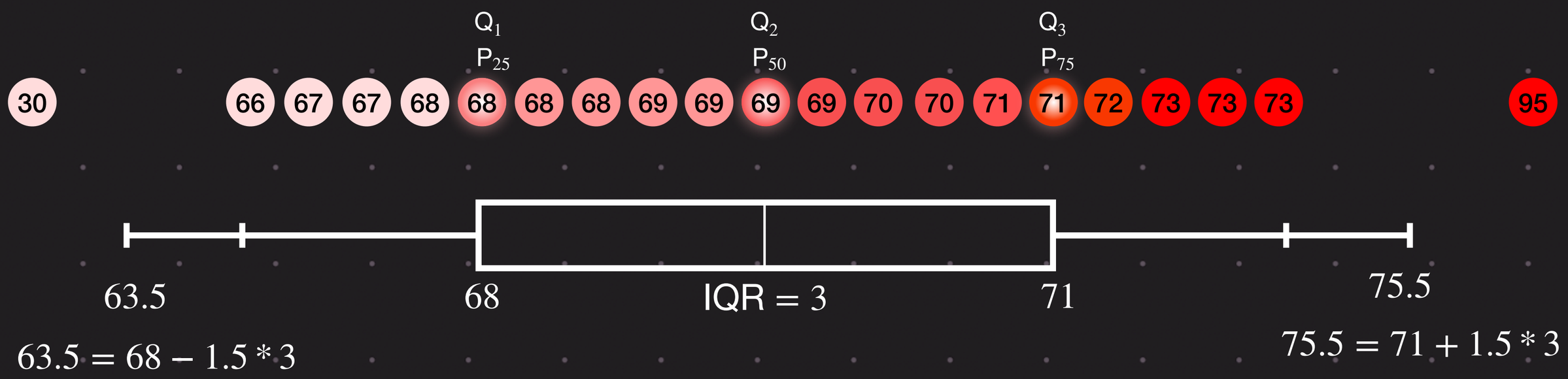
Percentiles, Quartiles, Inter Quartile range (IQR)



Percentiles, Quartiles, Inter Quartile range (IQR)



Percentiles, Quartiles, Inter Quartile range (IQR)



$63.5 = 68 - 1.5 * 3$

$75.5 = 71 + 1.5 * 3$

Outlier are points outside $[63.5,\ 75.5]$

Outlier are points outside $[Q_1 - 1.5 * IQR,\ Q_3 + 1.5 * IQR]$

Cumulative Distribution Function (CDF)

0.25

What fraction of people are shorter than this lady?

0.5

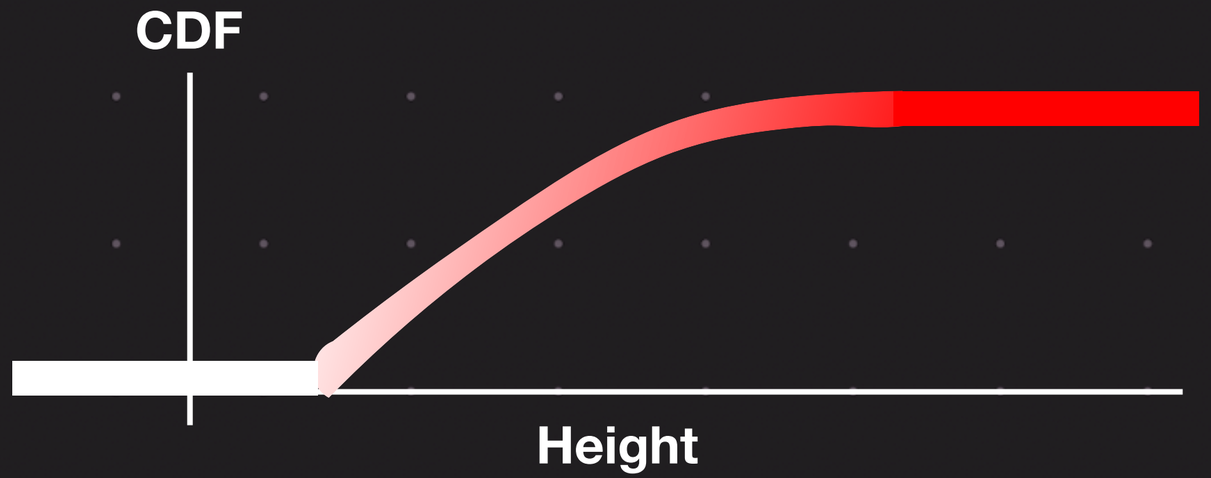
What fraction of people are shorter than this guy?

0.75

What fraction of people are shorter than this guy?

1

What fraction of people are shorter than this lady?



Simple Arithmetic

Original salary 30, 32, 35, 35, 38

Mean = 34

Median = 35

Mode = 35

Range = 38 - 30 = 8

IQR = 36.5 - 31 = 5.5

Effect of addition

After 5 L bonus

35, 37, 40, 40, 43

Mean = 39

Median = 40

Mode = 40

Range = 43 - 35 = 8

IQR = 41.5 - 36 = 5.5

Effect of multiplication

Salary in Yen: 1 Rs = 1.76 Yen

52.8 , 56.32, 61.6 , 61.6 , 66.88

Mean = 59.8

Median = 61.6

Mode = 61.6

Range = 66.88 - 52.8 = 14.08

IQR = 64.24 - 54.56 = 9.68