# Intro: Random Variables

*Mr. Merrick · September 20, 2025*

Consider the random sample from tikz village shown below. Tabulate the sample into a tidy data-frame.

Career: Engineer, Weight: 86 kg, Height: 183 cm, Income: $118k, Pets: 1

Career: Business, Weight: 81 kg, Height: 178 cm, Income: $132k, Pets: 0

Career: Chef, Weight: 73 kg, Height: 171 cm, Income: $62k, Pets: 2

Career: Nurse, Weight: 66 kg, Height: 168 cm, Income: $94k, Pets: 1

Career: Physician, Weight: 78 kg, Height: 185 cm, Income: $228k, Pets: 1

Career: Pilot, Weight: 82 kg, Height: 181 cm, Income: $172k, Pets: 0

Career: Cowboy, Weight: 84 kg, Height: 186 cm, Income: $55k, Pets: 2

Career: Builder, Weight: 92 kg, Height: 187 cm, Income: $78k, Pets: 0

Career: Business, Weight: 88 kg, Height: 182 cm, Income: $149k, Pets: 1

Career: Chef, Weight: 69 kg, Height: 168 cm, Income: $57k, Pets: 3

Career: Nurse, Weight: 72 kg, Height: 174 cm, Income: $88k, Pets: 0

Career: Physician, Weight: 74 kg, Height: 179 cm, Income: $204k, Pets: 2

Career: Pilot, Weight: 79 kg, Height: 176 cm, Income: $165k, Pets: 1

Career: Cowboy, Weight: 77 kg, Height: 180 cm, Income: $51k, Pets: 1

Career: Engineer, Weight: 89 kg, Height: 186 cm, Income: $127k, Pets: 2

Career: Pilot, Weight: 86 kg, Height: 184 cm, Income: $181k, Pets: 1

Career: Physician, Weight: 70 kg, Height: 177 cm, Income: $193k, Pets: 0

Career: Nurse, Weight: 64 kg, Height: 165 cm, Income: $86k, Pets: 1

Career: Chef, Weight: 82 kg, Height: 178 cm, Income: $67k, Pets: 1

Career: Business, Weight: 76 kg, Height: 175 cm, Income: $121k, Pets: 1

Career: Cowboy, Weight: 80 kg, Height: 182 cm, Income: $58k, Pets: 3

Career: Business, Weight: 90 kg, Height: 186 cm, Income: $171k, Pets: 1

Career: Builder, Weight: 85 kg, Height: 181 cm, Income: $72k, Pets: 2

Career: Nurse, Weight: 69 kg, Height: 170 cm, Income: $95k, Pets: 2

Career: Physician, Weight: 82 kg, Height: 188 cm, Income: $239k, Pets: 0

Career: Pilot, Weight: 75 kg, Height: 178 cm, Income: $159k, Pets: 0

Career: Chef, Weight: 77 kg, Height: 173 cm, Income: $64k, Pets: 2

Career: Cowboy, Weight: 79 kg, Height: 179 cm, Income: $47k, Pets: 1

Career: Physician, Weight: 73 kg, Height: 176 cm, Income: $212k, Pets: 2

Career: Nurse, Weight: 67 kg, Height: 169 cm, Income: $90k, Pets: 0

Career: Pilot, Weight: 88 kg, Height: 185 cm, Income: $186k, Pets: 1

Career: Engineer, Weight: 83 kg, Height: 180 cm, Income: $112k, Pets: 0

Career: Business, Weight: 84 kg, Height: 180 cm, Income: $138k, Pets: 1

Career: Chef, Weight: 70 kg, Height: 169 cm, Income: $55k, Pets: 1

Career: Cowboy, Weight: 85 kg, Height: 183 cm, Income: $53k, Pets: 2

| Career | Weight (kg) | Height (cm) | Income ($k) | Pets |
|--------|-------------|-------------|-------------|------|
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**1.** How many *variables* were recorded from the sample? _____     How many *observations*? _____

**2.** Classify each variable (circle one per section).

| Variable | Type | | | Scale | | | |
|---|---|---|---|---|---|---|---|
| | Categorical | Quantitative — Discrete. | Quantitative — Continuous | Nominal | Ordinal | Ratio | Interval |
| Career | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Weight | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Height | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Income | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Pets | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

## 3. Histogram of Income (in $k)

Tally the counts in each bin (half-open: [a,b)). Add dotted vertical lines for the sample *median* and *mean*.

| Bin | Count |
|---|---|
| [40,60) | |
| [60,80) | |
| [80,100) | |
| [100,120) | |
| [120,140) | |
| [140,160) | |
| [160,180) | |
| [180,200) | |
| [200,220) | |
| [220,240) | |
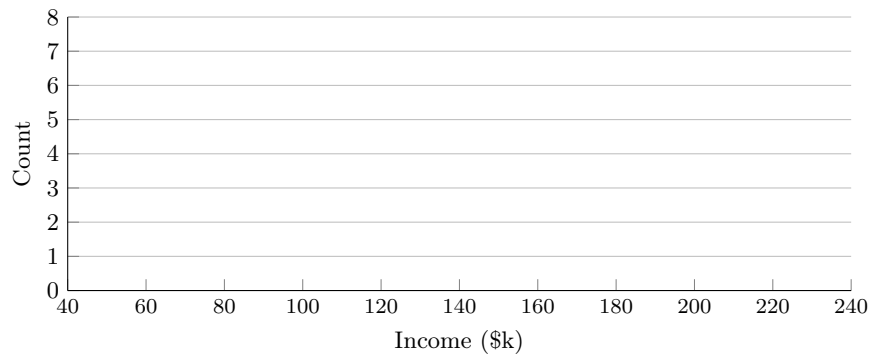
## 4. Bar Chart of Career

Tally the counts and proportions by career, then draw the bars.

| Career | Count | Proportion |
|---|---|---|
| Builder | | |
| Engineer | | |
| Businessman | | |
| Chef | | |
| Nurse | | |
| Physician | | |
| Pilot | | |
| Cowboy | | |
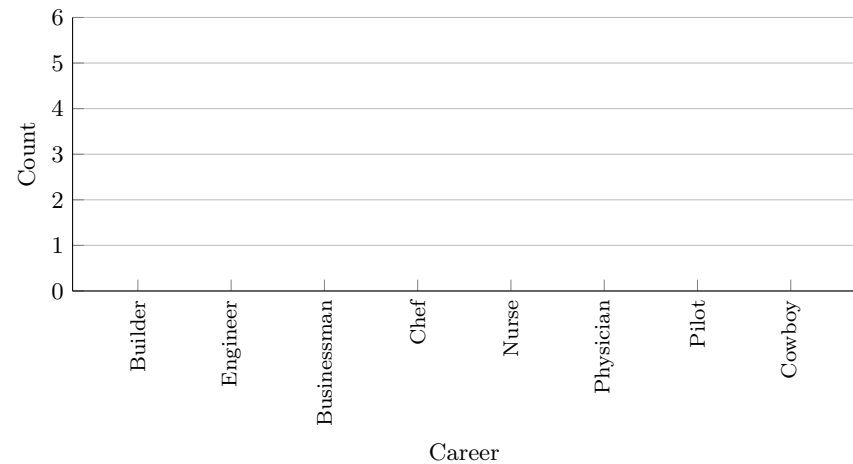
## 5. Box plot of Weights (kg)

*Use the sorted weights below to compute the five-number summary, then sketch the box plot. In solutions mode the box is drawn automatically.*

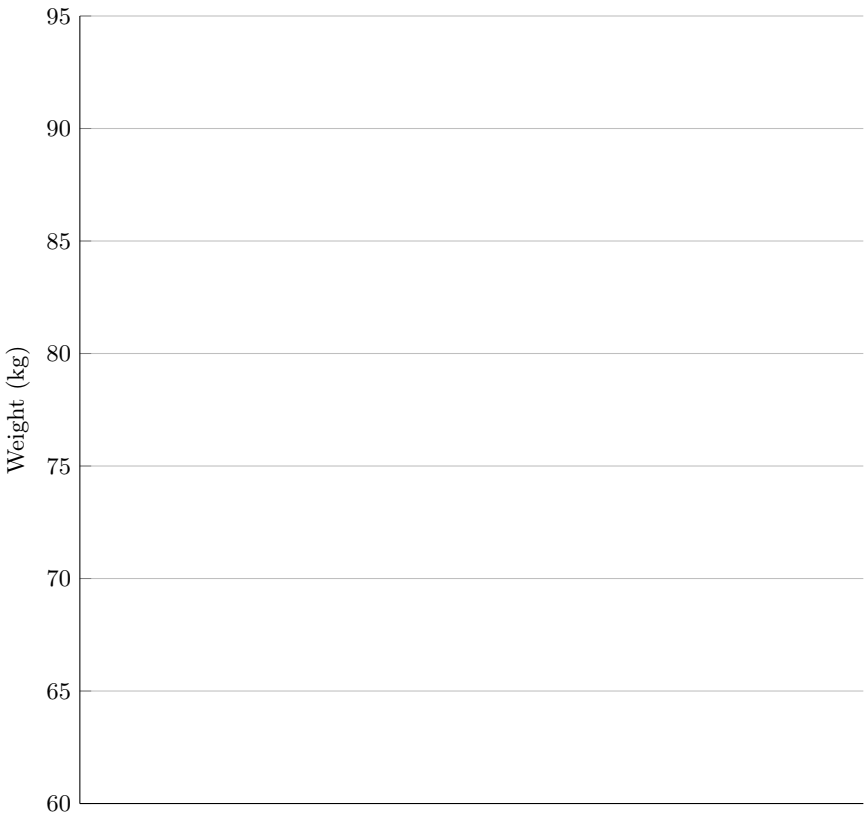| | | | | | | |
|---|---|---|---|---|---|---|
| 64 | 66 | 67 | 69 | 69 | 70 | 70 |
| 72 | 73 | 73 | 75 | 76 | 77 | 77 |
| 78 | 79 | 79 | 80 | 81 | 82 | 82 |
| 82 | 83 | 84 | 84 | 85 | 85 | 86 |
| 86 | 88 | 88 | 89 | 90 | 92 | |

| | |
|---|---|
| Minimum | |
| Q1 | |
| Median (Q2) | |
| Q3 | |
| Maximum | |

## 6. Scatter plot: Weight (kg) vs. Height (cm)

*Use the tabulated pairs (kg, cm) to plot the scatter. In solutions mode the points are drawn automatically.*

| (W,H) | | (W,H) | | (W,H) | | (W,H) | | (W,H) | |
|---|---|---|---|---|---|---|---|---|---|
| 86 | 183 | 81 | 178 | 73 | 171 | 66 | 168 | 78 | 185 |
| 82 | 181 | 84 | 186 | 92 | 187 | 88 | 182 | 69 | 168 |
| 72 | 174 | 74 | 179 | 79 | 176 | 77 | 180 | 89 | 186 |
| 86 | 184 | 70 | 177 | 64 | 165 | 82 | 178 | 76 | 175 |
| 80 | 182 | 90 | 186 | 85 | 181 | 69 | 170 | 82 | 188 |
| 75 | 178 | 77 | 173 | 79 | 179 | 73 | 176 | 67 | 169 |
| 88 | 185 | 83 | 180 | 84 | 180 | 70 | 169 | 85 | 183 |
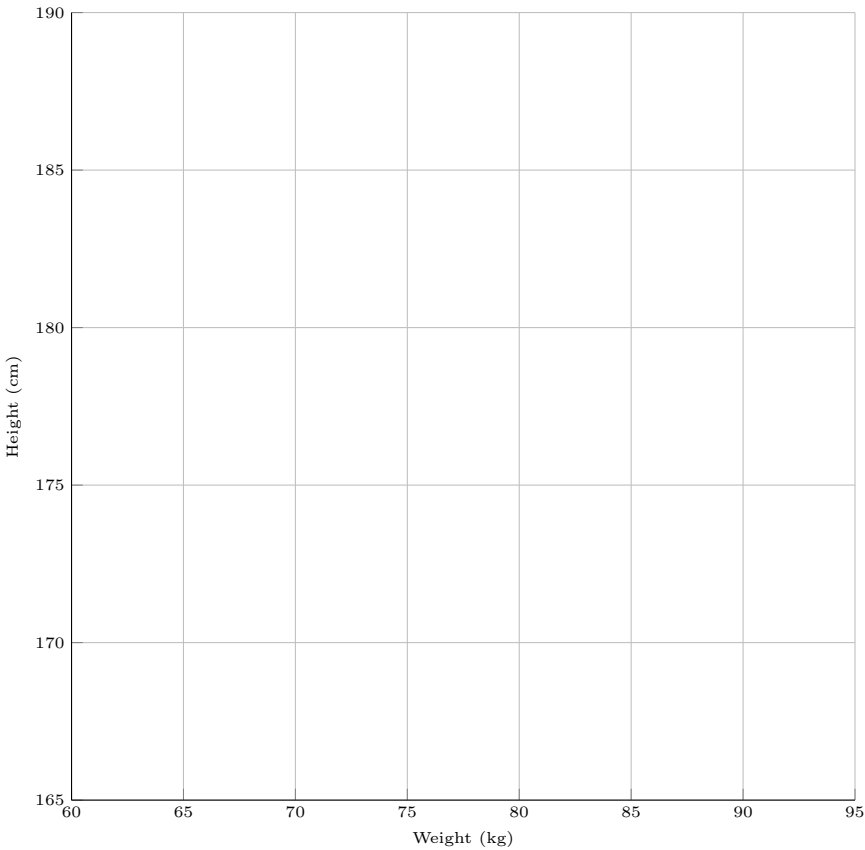
**7.** What does the scatter plot suggest about the relationship between *Weight* and *Height*? Briefly describe the direction and strength.

_____

_____

## 8. Income by Career — Pairwise Box Plots

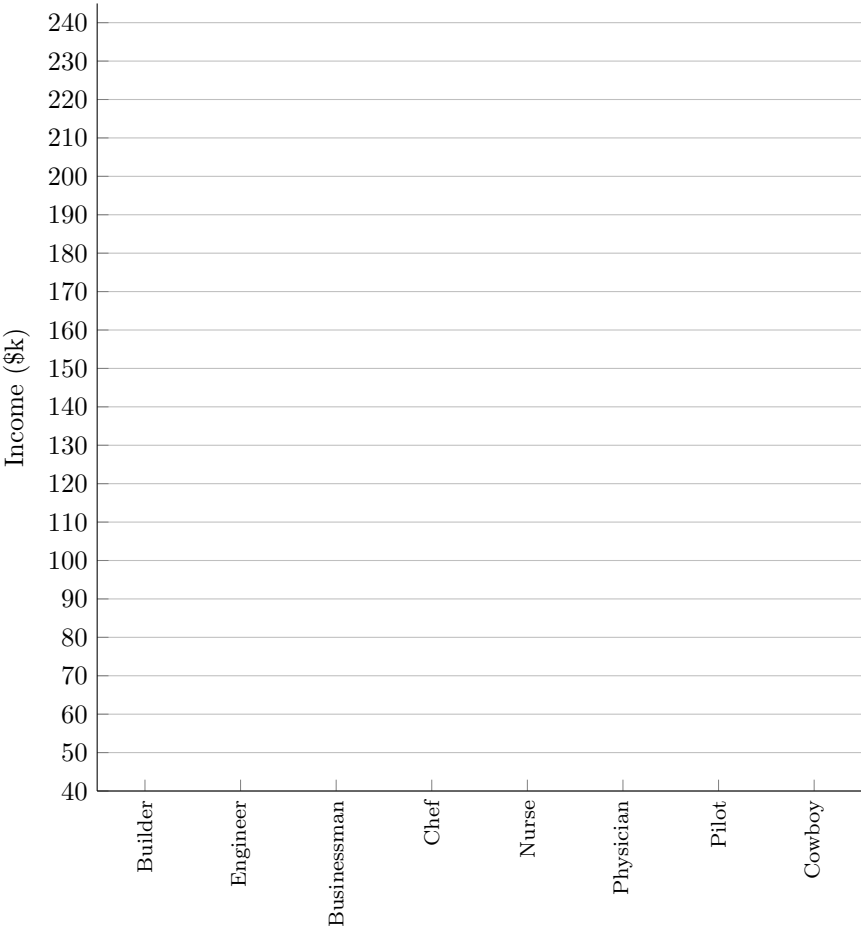Draw pairwise boxplots so that each box summarizes the income distribution (in $k) for a career.

| Career | Min | Q1 | Median | Q3 | Max |
|---|---|---|---|---|---|
| Builder | 72 | 72 | 75 | 78 | 78 |
| Engineer | 112 | 112 | 118 | 127 | 127 |
| Businessman | 121 | 132 | 138 | 149 | 171 |
| Chef | 55 | 57 | 62 | 64 | 67 |
| Nurse | 86 | 88 | 90 | 94 | 95 |
| Physician | 193 | 204 | 212 | 228 | 239 |
| Pilot | 159 | 165 | 172 | 181 | 186 |
| Cowboy | 47 | 51 | 53 | 55 | 58 |



## 9. Basic Probability

Let one person be selected uniformly at random from the 35 individuals. Provide answers as exact fractions and/or decimals.

1. $P(\text{Physician}) = $ _____

2. $P(\text{Physician and Income} > 200\text{k}) = $ _____

3. $P(\text{Income} \geq 100\text{k}) = $ _____

4. $P(\text{Engineer} \mid \text{Income} \geq 100\text{k}) = $ _____

5. $P(\text{Pilot or Physician}) = $ _____

6. $P(\text{Pets} \geq 2) = $ _____

7. $P(40\text{k} \leq \text{Income} < 100\text{k}) = $ _____