Solutions 1

Jumping Rivers

Question 1 - Helicopters

a) In teams of 2/3, cut and fold your helicopter into shape.

b) Time your helicopter falling to the ground from the same height as everyone else

c) Enter everyone's results into a **pandas** DataFrame called `heli` with two variables, `length` & `time`.

```
import pandas as pd
heli = pd.DataFrame({
    "length": [2, 4, 6, 8, 10, 12],
    "time": [0.5, 0.63, 0.75, 0.81, 1.03, 0.85]
})
```

d) Produce a scatter plot of length against time. What does this tell you?

```
import seaborn as sns
sns.scatterplot(x="length", y="time", data=heli)
```

e) Perform linear regression with the model $time = \beta_0 + \beta_1 \times length$. What is the value of β_1 and what does this tell you about the relationship between the length of the helicopter's blades and the time it takes to reach the ground?

```
from sklearn import linear_model
X_train = heli[["length"]]
y_train = heli["time"]
model = linear_model.LinearRegression()
model.fit(X_train, y_train)
model.coef_
```

f) Overlay the model line using the fitted values.

```
fitted = model.predict(X_train)
sns.scatterplot(x="length", y="time", data=heli)
sns.lineplot(x=heli["length"], y=fitted)
```

g) What is the residual sum of squares for the fitted model?

```
resid = fitted - y_train
import numpy as np
np.square(resid).sum()
```

h) Before we time the helicopter with 14cm blades, use your model to predict how long it will take.

```
model.predict(np.array(14, ndmin=2))
```