Portfolio assignment 17

30 min: Train a decision tree to predict the body_mass_g of a penguin based on their characteristics.

- Split the penguin dataset into a train (70%) and test (30%) set.
- Use the train set to fit a DecisionTreeRegressor. You are free to to choose which columns you want to use as feature variables and you are also free to choose the max_depth of the tree. **Note**: Some machine learning algorithms can not handle missing values. You will either need to
  - replace missing values (with the mean or most popular value). For replacing missing values you can use .fillna(\<value>) https://pandas.pydata.org/docs/reference/api/pandas.Series.fillna.html
  - remove rows with missing data. You can remove rows with missing data with .dropna() https://pandas.pydata.org/pandas-docs/stable/reference/api/pandas.DataFrame.dropna.html
- Use your decision tree model to make predictions for both the train and test set.
- Calculate the RMSE for both the train set predictions and test set predictions.
- Is the RMSE different? Did you expect this difference?
- Use the plot_tree_regression function above to create a plot of the decision tree. Take a few minutes to analyse the decision tree. Do you understand the tree?

Regression

When the target variable is a numerical variable then we refer to this task as a regression task.

Examples of regression tasks:

- Predict the price people are willing to pay for a house.
- Predict the salary a student will earn in the future.

Examples of machine learning algorithms that we could use for regression:

- Decision trees
- Random forests
- Linear regression
- Neural networks

In [1]:

```
import pandas as pd
import seaborn as sns
```

In [2]:

```
penguins = sns.load_dataset("penguins")
penguins.head()
```

Out[2]:

	species	island	bill_length_mm	bill_depth_mm	flipper_length_mm	body_mass_g	sex
0	Adelie	Torgersen	39.1	18.7	181.0	3750.0	Male
1	Adelie	Torgersen	39.5	17.4	186.0	3800.0	Female
2	Adelie	Torgersen	40.3	18.0	195.0	3250.0	Female
3	Adelie	Torgersen	NaN	NaN	NaN	NaN	NaN
4	Adelie	Torgersen	36.7	19.3	193.0	3450.0	Female

In [3]:

```
from sklearn.tree import DecisionTreeRegressor
```

In [4]:

```
penguins = penguins.dropna() # removing a low amount of na's
```

In [5]:

```
features= ['body_mass_g']
dt_regression = DecisionTreeRegressor(max_depth = 3) # Increase max_depth to see effe
dt_regression.fit(penguins[features], penguins['bill_length_mm'])
```

Out[5]:

```
DecisionTreeRegressor(max_depth=3)
```

In [6]:

```
from sklearn import tree
import graphviz

def plot_tree_regression(model, features):
    # Generate plot data
    dot_data = tree.export_graphviz(model, out_file=None,
                          feature_names=features,
                          filled=True, rounded=True,
                          special_characters=True)

    # Turn into graph using graphviz
    graph = graphviz.Source(dot_data)

    # Write out a pdf
    graph.render("decision_tree")

    # Display in the notebook
    return graph
```

In [7]:

```
def calculate_rmse(predictions, actuals):
    if(len(predictions) != len(actuals)):
        raise Exception("The amount of predictions did not equal the amount of actual

    return ((predictions - actuals) ** 2).sum() / len(actuals)) ** (1/2)
```

In [8]:

```
predictionsOnTrainset = dt_regression.predict(penguins[features])
predictionsOnTestset = dt_regression.predict(penguins[features])

rmseTrain = calculate_rmse(predictionsOnTrainset, penguins.bill_length_mm)
rmseTest = calculate_rmse(predictionsOnTestset, penguins.bill_length_mm)

print("RMSE on training set " + str(rmseTrain))
print("RMSE on test set " + str(rmseTest))
```

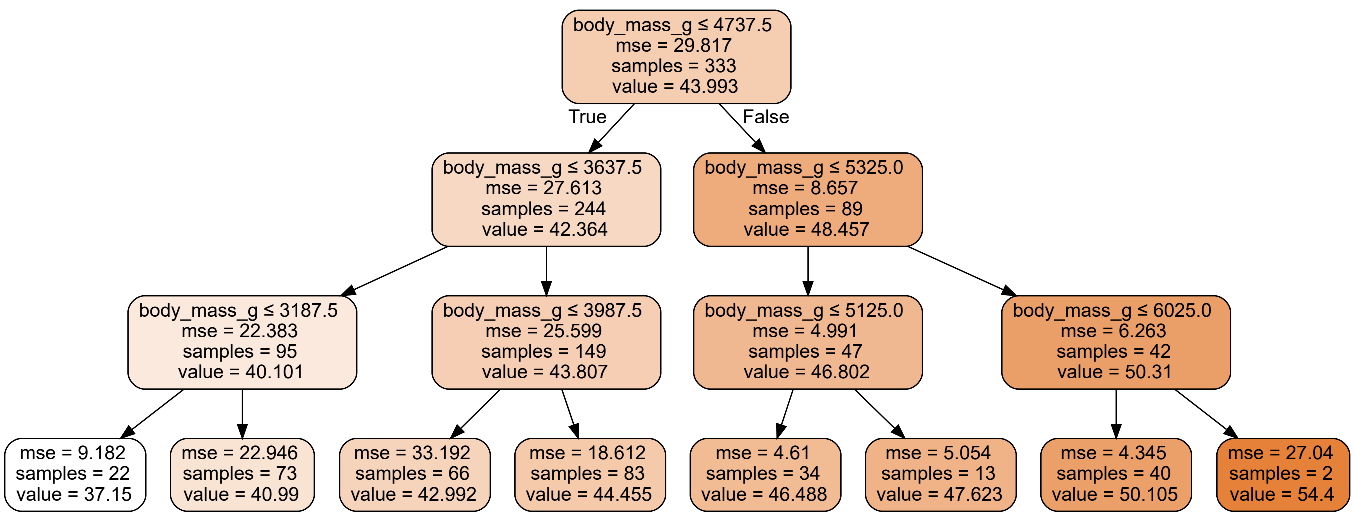
```
RMSE on training set 4.266950627893799
RMSE on test set 4.266950627893799
```

The difference seems to be very minimal, this means the training set can probably predict the output very well. The errors SHOULD be minimal, but you're never sure.

In [9]:

```
plot_tree_regression(dt_regression, features)
```

Out[9]:



In [ ]: