In [1]:
```
# Import Libraries
import numpy as np
import pandas as pd
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
```

In [2]:
```
# Load dataset
data = pd.read_csv('iris.csv')
data.head()
```

Out[2]:

	sepal.length	sepal.width	petal.length	petal.width	variety
0	5.1	3.5	1.4	0.2	Setosa
1	4.9	3.0	1.4	0.2	Setosa
2	4.7	3.2	1.3	0.2	Setosa
3	4.6	3.1	1.5	0.2	Setosa
4	5.0	3.6	1.4	0.2	Setosa

In [3]:
```
data.shape
```

Out[3]:
```
(150, 5)
```

In [4]:
```
X = data[['sepal.length', 'sepal.width', 'petal.length', 'petal.width']].values

#label_to_int = {label: idx for idx, label in enumerate(df['variety'].unique())}
# Create the target vector 'target'
y = data['variety'].values
```

In [5]:
```
# Get dummy variable
y = pd.get_dummies(y).values

y[:3]
```

Out[5]:
```
array([[1, 0, 0],
       [1, 0, 0],
       [1, 0, 0]], dtype=uint8)
```

In [6]:
```
#Split data into train and test data
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=20, random_state=
```

In [7]:
```
# Initialize variables
learning_rate = 0.1
iterations = 5000
N = y_train.size

# number of input features
input_size = 4

# number of hidden layers neurons
hidden_size = 2

# number of neurons at the output layer
output_size = 3

results = pd.DataFrame(columns=["mse", "accuracy"])
```

In [8]:
```
# Initialize weights
np.random.seed(10)

# initializing weight for the hidden layer
W1 = np.random.normal(scale=0.5, size=(input_size, hidden_size))

# initializing weight for the output layer
W2 = np.random.normal(scale=0.5, size=(hidden_size , output_size))
```

In [9]:
```
def sigmoid(x):
    return 1 / (1 + np.exp(-x))

def mean_squared_error(y_pred, y_true):
    return ((y_pred - y_true)**2).sum() / (2*y_pred.size)

def accuracy(y_pred, y_true):
    acc = y_pred.argmax(axis=1) == y_true.argmax(axis=1)
    return acc.mean()
```

In [10]:
```python
for itr in range(iterations):

    # feedforward propagation
    # on hidden layer
    Z1 = np.dot(X_train, W1)
    A1 = sigmoid(Z1)

    # on output layer
    Z2 = np.dot(A1, W2)
    A2 = sigmoid(Z2)


    # Calculating error
    mse = mean_squared_error(A2, y_train)
    acc = accuracy(A2, y_train)
    results=results.append({"mse":mse, "accuracy":acc},ignore_index=True )

    # backpropagation
    E1 = A2 - y_train
    dW1 = E1 * A2 * (1 - A2)

    E2 = np.dot(dW1, W2.T)
    dW2 = E2 * A1 * (1 - A1)


    # weight updates
    W2_update = np.dot(A1.T, dW1) / N
    W1_update = np.dot(X_train.T, dW2) / N

    W2 = W2 - learning_rate * W2_update
    W1 = W1 - learning_rate * W1_update
```

```
  results=results.append({"mse":mse, "accuracy":acc},ignore_index=True )
C:\Users\Dell\AppData\Local\Temp\ipykernel_10888\548591417.py:16: FutureWarning:
The frame.append method is deprecated and will be removed from pandas in a future
version. Use pandas.concat instead.
  results=results.append({"mse":mse, "accuracy":acc},ignore_index=True )
C:\Users\Dell\AppData\Local\Temp\ipykernel_10888\548591417.py:16: FutureWarning:
The frame.append method is deprecated and will be removed from pandas in a future
version. Use pandas.concat instead.
  results=results.append({"mse":mse, "accuracy":acc},ignore_index=True )
C:\Users\Dell\AppData\Local\Temp\ipykernel_10888\548591417.py:16: FutureWarning:
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  results=results.append({"mse":mse, "accuracy":acc},ignore_index=True )
C:\Users\Dell\AppData\Local\Temp\ipykernel_10888\548591417.py:16: FutureWarning:
The frame.append method is deprecated and will be removed from pandas in a future
version. Use pandas.concat instead.
```
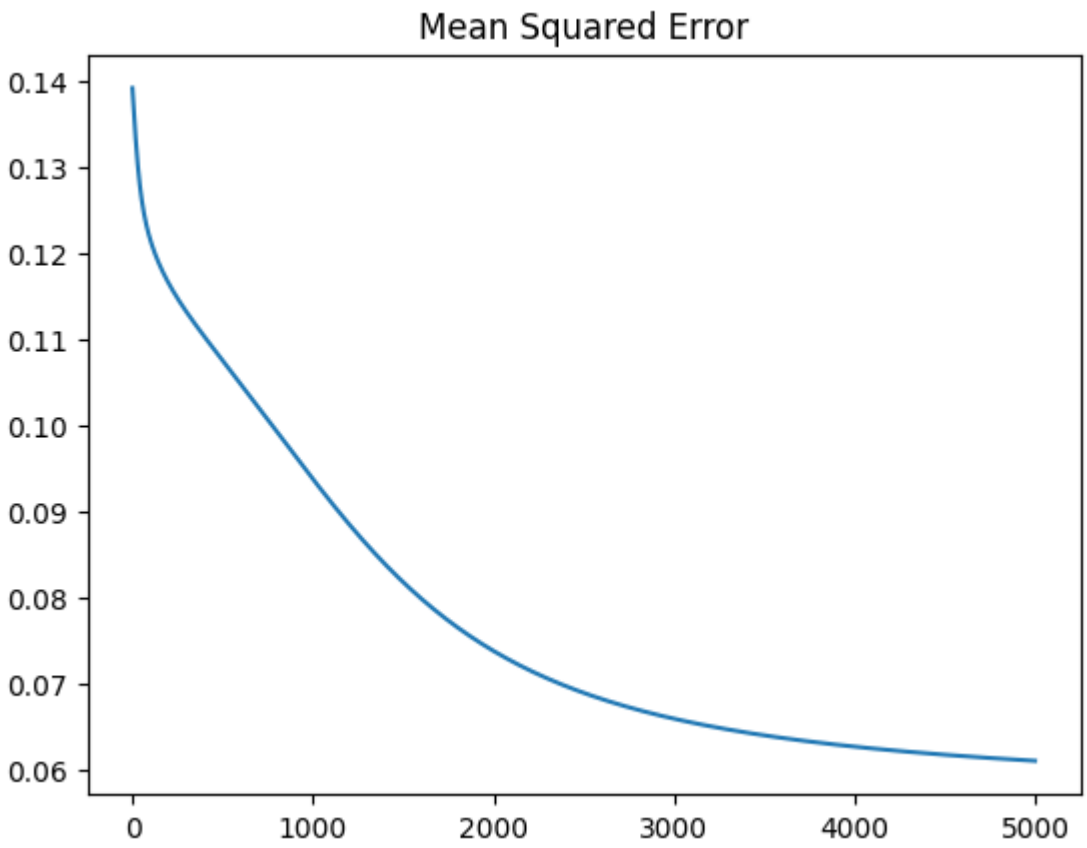
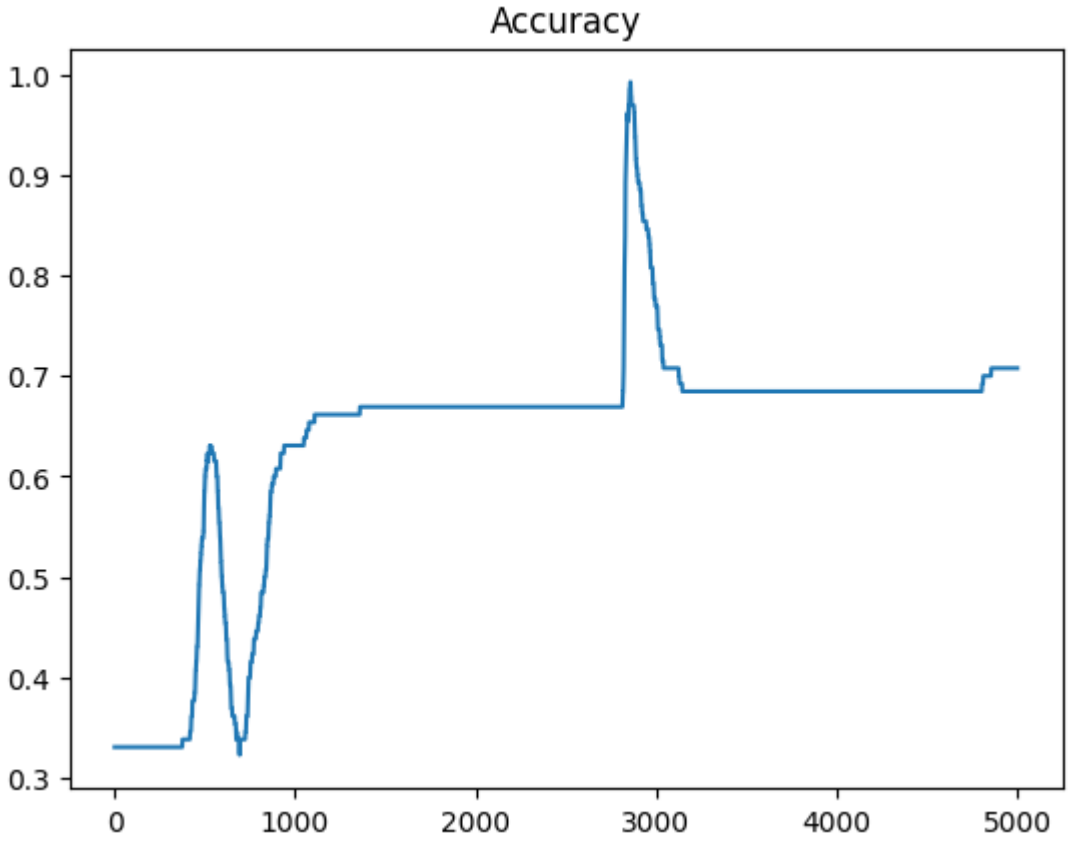

In [11]:
```
results.mse.plot(title="Mean Squared Error")
```

Out[11]:
```
<AxesSubplot: title={'center': 'Mean Squared Error'}>
```



In [12]:
```
results.accuracy.plot(title="Accuracy")
```

Out[12]:
```
<AxesSubplot: title={'center': 'Accuracy'}>
```



In [13]:
```
# feedforward
Z1 = np.dot(X_test, W1)
A1 = sigmoid(Z1)

Z2 = np.dot(A1, W2)
A2 = sigmoid(Z2)

acc = accuracy(A2, y_test)
print("Accuracy: {}".format(acc))
```

```
Accuracy: 0.8
```