HIDDEN LAYERS	NEURONS	LOSS FUNCTION	OPTIMIZERS	ACTIVATE FUNCTION	DROPOUT	EPOCH(HIGHEST ACCURACY)	VALIDATION ACCURACY	TEST ACCURACY
1	16	MSE	ADAM	TANH		20	0.9115	0.885
1	32	MSE	ADAM	TANH		2	0.9557	0.8799
1	64	MSE	ADAM	TANH	0.9614(dropo	4	0.9287	0.8858
1	128	MSE	ADAM	TANH		2	0.9318	0.8819
2	16	BINARY_CROSSENTROPY	RMSPROP	RELU		2		
2	16	MSE	ADAM	TANH			0.9596	0.8762
2	32	MSE	ADAM	TANH		20	0.929	0.8807
2	64	MSE	ADAM	TANH			0.9332	0.8775
2	128	MSE	ADAM	TANH			0.9555	0.8706
3	16	MSE	ADAM	TANH			0.950	0.8746
3	32	MSE	ADAM	TANH			0.8696	0.8695
3	64	MSE	ADAM	TANH			0.9348	0.8766
3	128	MSE	ADAM	TANH			0.935	0.8766

In [ ]:

```
Summary:
1. When used each hidden layers 1,2,3 to execute with neurons 16, 32, 64 we c
2. We have used generalization technique dropout to the one which have maximu
3. Comparing the test accuracy values of highest accuracy algorithm one with
```

In [54]:

```
from tensorflow.keras.datasets import imdb
(train_data, train_labels), (test_data, test_labels) = imdb.load_data(
    num_words=10000)
```

In [55]:

```
train_data[0]
```

```
 16,

 38,
 1334,
 88,
 12,
 16,
 283,
 5,
 16,
 4472,
 113,
 103,
 32,
 15,
 16,
 5345,
 19,
 178,
 32]
```

In [56]:

```
train_labels[0]
```

Out[56]: 1

In [57]:

```
max([max(sequence) for sequence in train_data])
```

Out[57]: 9999

In [58]:
```
#Decoding reviews back to text
```

In [59]:
```
word_index = imdb.get_word_index()
reverse_word_index = dict(
    [(value, key) for (key, value) in word_index.items()])
decoded_review = " ".join(
    [reverse_word_index.get(i - 3, "?") for i in train_data[0]])
```

In [60]:
```
#Preparinf data set
```

In [61]:
```
import numpy as np
def vectorize_sequences(sequences, dimension=10000):
    results = np.zeros((len(sequences), dimension))
    for i, sequence in enumerate(sequences):
        for j in sequence:
            results[i, j] = 1.
    return results
x_train = vectorize_sequences(train_data)
x_test = vectorize_sequences(test_data)
```

In [62]:
```
x_train[0]
```

Out[62]:
```
array([0., 1., 1., ..., 0., 0., 0.])
```

In [63]:
```
y_train = np.asarray(train_labels).astype("float32")
y_test = np.asarray(test_labels).astype("float32")
```

In [64]:
```
#Buliding Model
```

In [65]:
```
from tensorflow import keras
from tensorflow.keras import layers

model = keras.Sequential([
    layers.Dense(16, activation="relu"),
    layers.Dense(16, activation="relu"),
    layers.Dense(1, activation="sigmoid")
])
```

In [66]:
```
model.compile(optimizer="adam",
              loss="binary_crossentropy",
              metrics=["accuracy"])
```

In [67]:
```
#Validating your approach
```

In [68]:
```
x_val = x_train[:10000]
partial_x_train = x_train[10000:]
y_val = y_train[:10000]
partial_y_train = y_train[10000:]
```

In [69]:
```
#Training  model
```

In [70]:
```
history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))
```

```
Epoch 1/20
30/30 [==============================] - 2s 37ms/step - loss: 0.5723 - a
ccuracy: 0.7423 - val_loss: 0.4117 - val_accuracy: 0.8559
Epoch 2/20
30/30 [==============================] - 1s 20ms/step - loss: 0.3069 - a
ccuracy: 0.8981 - val_loss: 0.2954 - val_accuracy: 0.8897
Epoch 3/20
30/30 [==============================] - 1s 21ms/step - loss: 0.2039 - a
ccuracy: 0.9321 - val_loss: 0.2809 - val_accuracy: 0.8894
Epoch 4/20
30/30 [==============================] - 1s 18ms/step - loss: 0.1508 - a
ccuracy: 0.9517 - val_loss: 0.2881 - val_accuracy: 0.8842
Epoch 5/20
30/30 [==============================] - 1s 21ms/step - loss: 0.1157 - a
ccuracy: 0.9666 - val_loss: 0.2975 - val_accuracy: 0.8834
Epoch 6/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0873 - a
ccuracy: 0.9781 - val_loss: 0.3164 - val_accuracy: 0.8816
Epoch 7/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0670 - a
ccuracy: 0.9857 - val_loss: 0.3394 - val_accuracy: 0.8822
Epoch 8/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0507 - a
ccuracy: 0.9908 - val_loss: 0.3666 - val_accuracy: 0.8782
Epoch 9/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0384 - a
ccuracy: 0.9947 - val_loss: 0.3926 - val_accuracy: 0.8769
Epoch 10/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0292 - a
ccuracy: 0.9973 - val_loss: 0.4190 - val_accuracy: 0.8756
Epoch 11/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0216 - a
ccuracy: 0.9987 - val_loss: 0.4471 - val_accuracy: 0.8732
Epoch 12/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0164 - a
ccuracy: 0.9993 - val_loss: 0.4739 - val_accuracy: 0.8724
Epoch 13/20
30/30 [==============================] - 1s 17ms/step - loss: 0.0128 - a
ccuracy: 0.9995 - val_loss: 0.4960 - val_accuracy: 0.8709
Epoch 14/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0100 - a
ccuracy: 0.9998 - val_loss: 0.5181 - val_accuracy: 0.8708
Epoch 15/20
30/30 [==============================] - 1s 17ms/step - loss: 0.0078 - a
ccuracy: 1.0000 - val_loss: 0.5379 - val_accuracy: 0.8707
Epoch 16/20
30/30 [==============================] - 0s 17ms/step - loss: 0.0063 - a
ccuracy: 1.0000 - val_loss: 0.5573 - val_accuracy: 0.8703
Epoch 17/20
30/30 [==============================] - 0s 17ms/step - loss: 0.0052 - a
```

```
ccuracy: 1.0000 - val_loss: 0.5738 - val_accuracy: 0.8697
Epoch 18/20
30/30 [==============================] - 0s 17ms/step - loss: 0.0044 - a
ccuracy: 1.0000 - val_loss: 0.5906 - val_accuracy: 0.8685
Epoch 19/20
30/30 [==============================] - 0s 16ms/step - loss: 0.0037 - a
ccuracy: 1.0000 - val_loss: 0.6053 - val_accuracy: 0.8684
Epoch 20/20
30/30 [==============================] - 0s 16ms/step - loss: 0.0032 - a
ccuracy: 1.0000 - val_loss: 0.6202 - val_accuracy: 0.8680
```

In [71]:

```
#Compiling the model
```

In [72]:

```
history_dict = history.history
history_dict.keys()
```

Out[72]:

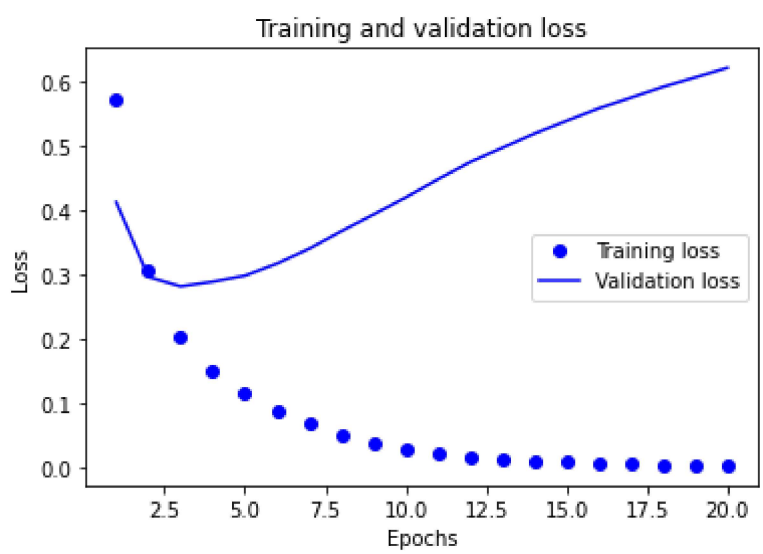
```
dict_keys(['loss', 'accuracy', 'val_loss', 'val_accuracy'])
```

In [73]:

```
#Plotting the training and validation loss
```

In [74]:

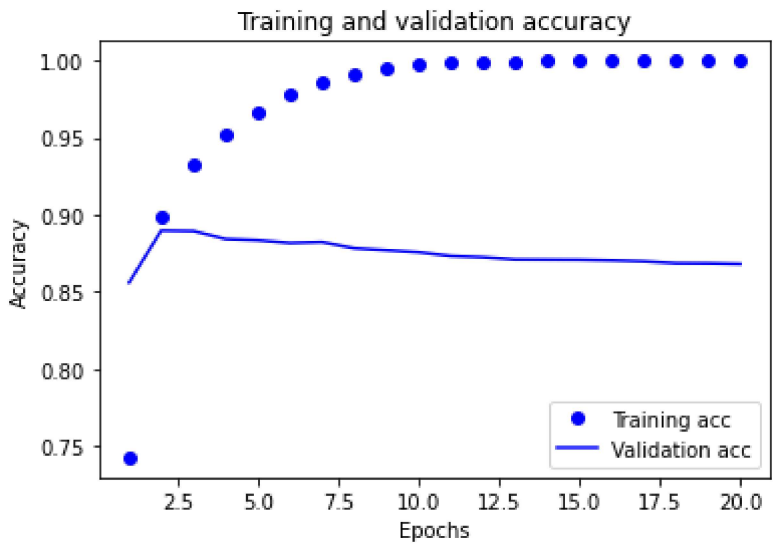
```
import matplotlib.pyplot as plt
history_dict = history.history
loss_values = history_dict["loss"]
val_loss_values = history_dict["val_loss"]
epochs = range(1, len(loss_values) + 1)
plt.plot(epochs, loss_values, "bo", label="Training loss")
plt.plot(epochs, val_loss_values, "b", label="Validation loss")
plt.title("Training and validation loss")
plt.xlabel("Epochs")
plt.ylabel("Loss")
plt.legend()
plt.show()
```



In [75]:

```
#Plotting the training and accuracy
```

In [76]:
```
plt.clf()
acc = history_dict["accuracy"]
val_acc = history_dict["val_accuracy"]
plt.plot(epochs, acc, "bo", label="Training acc")
plt.plot(epochs, val_acc, "b", label="Validation acc")
plt.title("Training and validation accuracy")
plt.xlabel("Epochs")
plt.ylabel("Accuracy")
plt.legend()
plt.show()
```



In [77]:
```
#Retraining a model from scratch
```

In [78]:
```
model = keras.Sequential([
    layers.Dense(16, activation="relu"),
    layers.Dense(16, activation="relu"),
    layers.Dense(1, activation="sigmoid")
])
model.compile(optimizer="rmsprop",
              loss="binary_crossentropy",
              metrics=["accuracy"])
model.fit(x_train, y_train, epochs=4, batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
49/49 [==============================] - 1s 12ms/step - loss: 0.4489 - accu
racy: 0.8226
Epoch 2/4
49/49 [==============================] - 1s 12ms/step - loss: 0.2586 - accu
racy: 0.9098
Epoch 3/4
49/49 [==============================] - 1s 12ms/step - loss: 0.2018 - accu
racy: 0.9287
Epoch 4/4
49/49 [==============================] - 1s 12ms/step - loss: 0.1692 - accu
racy: 0.9405
782/782 [==============================] - 2s 3ms/step - loss: 0.2959 - acc
uracy: 0.8827
```

In [79]:
```
results
```

Out[79]:
```
[0.29586344957351685, 0.8827199935913086]
```

In [80]:
```
#Using a trained model to generate predictions on new data
```

In [81]:
```
model.predict(x_test)
```

```
782/782 [==============================] - 2s 3ms/step
```

Out[81]:
```
array([[0.17031914],
       [0.9990291 ],
       [0.8739922 ],
       ...,
       [0.08244044],
       [0.05501057],
       [0.4795224 ]], dtype=float32)
```

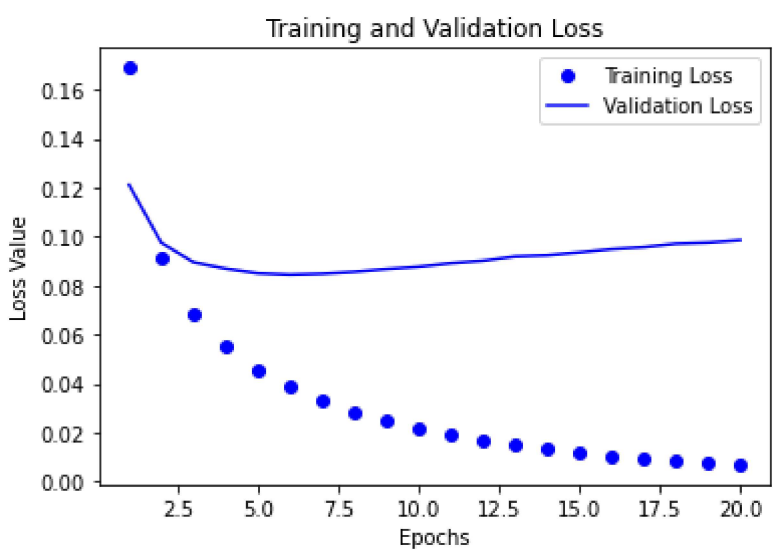
In [82]:

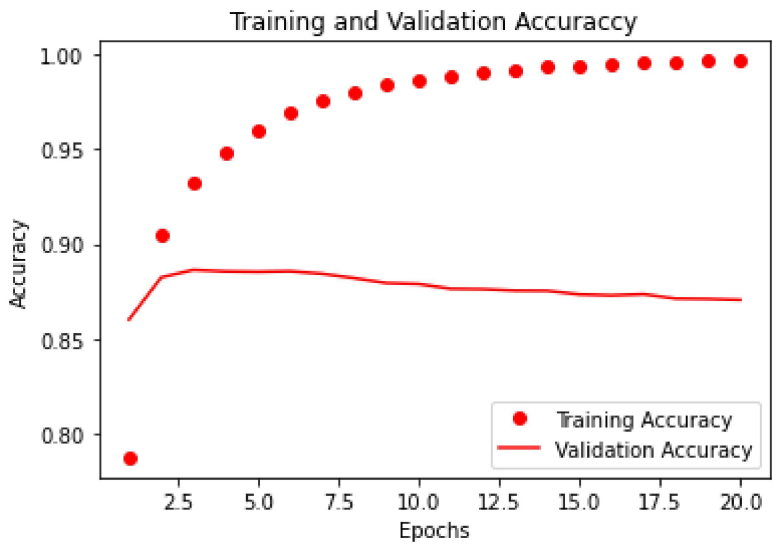
```
#implemented one hideden layer with 16 neurons and mse loss function

from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])



x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()

# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")
```

```
plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 2s 38ms/step - loss: 0.1689 - bina
ry_accuracy: 0.7874 - val_loss: 0.1211 - val_binary_accuracy: 0.8603
Epoch 2/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0916 - bina
ry_accuracy: 0.9045 - val_loss: 0.0975 - val_binary_accuracy: 0.8825
Epoch 3/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0684 - bina
ry_accuracy: 0.9324 - val_loss: 0.0895 - val_binary_accuracy: 0.8864
Epoch 4/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0552 - bina
ry_accuracy: 0.9481 - val_loss: 0.0869 - val_binary_accuracy: 0.8856
Epoch 5/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0456 - bina
ry_accuracy: 0.9603 - val_loss: 0.0850 - val_binary_accuracy: 0.8854
Epoch 6/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0386 - bina
ry_accuracy: 0.9694 - val_loss: 0.0844 - val_binary_accuracy: 0.8857
Epoch 7/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0329 - bina
ry_accuracy: 0.9756 - val_loss: 0.0848 - val_binary_accuracy: 0.8844
Epoch 8/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0284 - bina
ry_accuracy: 0.9800 - val_loss: 0.0856 - val_binary_accuracy: 0.8821
Epoch 9/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0247 - bina
ry_accuracy: 0.9839 - val_loss: 0.0867 - val_binary_accuracy: 0.8795
Epoch 10/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0215 - bina
```

```
ry_accuracy: 0.9867 - val_loss: 0.0877 - val_binary_accuracy: 0.8790
Epoch 11/20
30/30 [==============================] - 0s 16ms/step - loss: 0.0189 - bina
ry_accuracy: 0.9887 - val_loss: 0.0891 - val_binary_accuracy: 0.8765
Epoch 12/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0167 - bina
ry_accuracy: 0.9907 - val_loss: 0.0901 - val_binary_accuracy: 0.8763
Epoch 13/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0148 - bina
ry_accuracy: 0.9922 - val_loss: 0.0919 - val_binary_accuracy: 0.8755
Epoch 14/20
30/30 [==============================] - 1s 17ms/step - loss: 0.0131 - bina
ry_accuracy: 0.9935 - val_loss: 0.0923 - val_binary_accuracy: 0.8754
Epoch 15/20
30/30 [==============================] - 0s 17ms/step - loss: 0.0117 - bina
ry_accuracy: 0.9943 - val_loss: 0.0935 - val_binary_accuracy: 0.8735
Epoch 16/20
30/30 [==============================] - 1s 17ms/step - loss: 0.0104 - bina
ry_accuracy: 0.9948 - val_loss: 0.0949 - val_binary_accuracy: 0.8730
Epoch 17/20
30/30 [==============================] - 1s 17ms/step - loss: 0.0094 - bina
ry_accuracy: 0.9956 - val_loss: 0.0957 - val_binary_accuracy: 0.8736
Epoch 18/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0084 - bina
ry_accuracy: 0.9960 - val_loss: 0.0971 - val_binary_accuracy: 0.8713
Epoch 19/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0076 - bina
ry_accuracy: 0.9967 - val_loss: 0.0975 - val_binary_accuracy: 0.8711
Epoch 20/20
30/30 [==============================] - 0s 17ms/step - loss: 0.0070 - bina
ry_accuracy: 0.9969 - val_loss: 0.0985 - val_binary_accuracy: 0.8706
```





In [83]:

```
model = models.Sequential()
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

model.fit(x_train, y_train, epochs=2, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/2
49/49 [==============================] - 2s 11ms/step - loss: 0.1492 - accu
racy: 0.8221
Epoch 2/2
49/49 [==============================] - 1s 11ms/step - loss: 0.0818 - accu
racy: 0.9093
782/782 [==============================] - 2s 2ms/step - loss: 0.0926 - acc
uracy: 0.8840
```

Out[83]:

```
[0.09262750297784805, 0.8840000033378601]
```

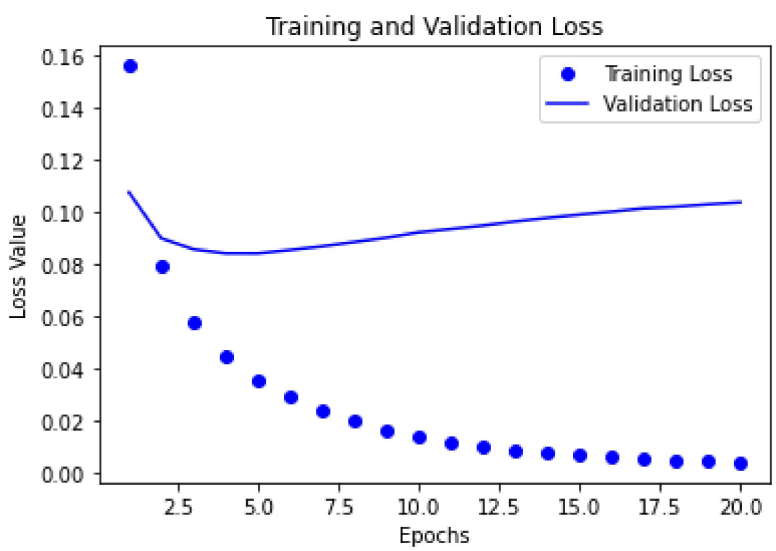
In [84]:

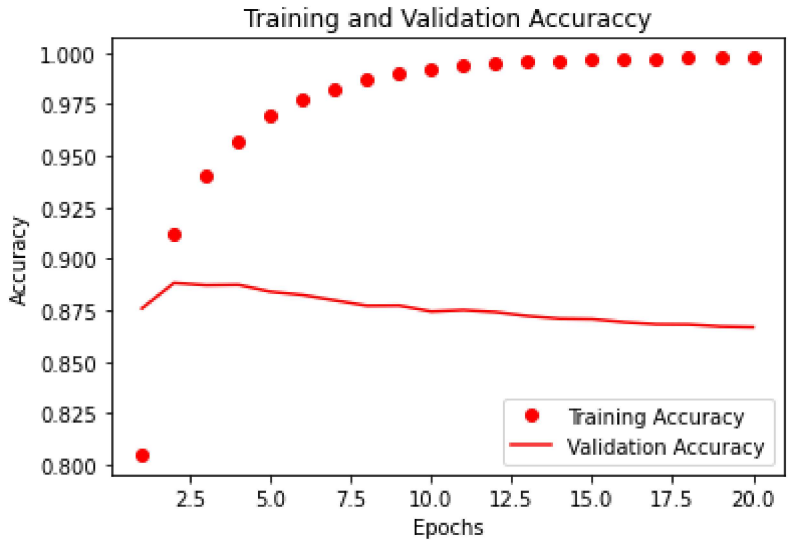
```
#implemented one hideden layer with 32 neurons and mse loss function

from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")

plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
```

```
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 2s 34ms/step - loss: 0.1561 - b
inary_accuracy: 0.8049 - val_loss: 0.1076 - val_binary_accuracy: 0.8759
Epoch 2/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0792 - b
inary_accuracy: 0.9123 - val_loss: 0.0900 - val_binary_accuracy: 0.8883
Epoch 3/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0576 - b
inary_accuracy: 0.9405 - val_loss: 0.0858 - val_binary_accuracy: 0.8872
Epoch 4/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0449 - b
inary_accuracy: 0.9571 - val_loss: 0.0843 - val_binary_accuracy: 0.8874
Epoch 5/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0359 - b
inary_accuracy: 0.9693 - val_loss: 0.0842 - val_binary_accuracy: 0.8840
Epoch 6/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0292 - b
inary_accuracy: 0.9777 - val_loss: 0.0855 - val_binary_accuracy: 0.8824
Epoch 7/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0241 - b
inary_accuracy: 0.9825 - val_loss: 0.0869 - val_binary_accuracy: 0.8798
Epoch 8/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0200 - b
inary_accuracy: 0.9867 - val_loss: 0.0886 - val_binary_accuracy: 0.8772
Epoch 9/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0168 - b
inary_accuracy: 0.9905 - val_loss: 0.0902 - val_binary_accuracy: 0.8773
Epoch 10/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0142 - b
inary_accuracy: 0.9921 - val_loss: 0.0923 - val_binary_accuracy: 0.8744
Epoch 11/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0120 - b
```

```
inary_accuracy: 0.9936 - val_loss: 0.0936 - val_binary_accuracy: 0.8751
Epoch 12/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0102 - b
inary_accuracy: 0.9949 - val_loss: 0.0949 - val_binary_accuracy: 0.8741
Epoch 13/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0089 - b
inary_accuracy: 0.9956 - val_loss: 0.0965 - val_binary_accuracy: 0.8722
Epoch 14/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0078 - b
inary_accuracy: 0.9962 - val_loss: 0.0978 - val_binary_accuracy: 0.8709
Epoch 15/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0068 - b
inary_accuracy: 0.9967 - val_loss: 0.0991 - val_binary_accuracy: 0.8707
Epoch 16/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0062 - b
inary_accuracy: 0.9972 - val_loss: 0.1003 - val_binary_accuracy: 0.8692
Epoch 17/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0055 - b
inary_accuracy: 0.9973 - val_loss: 0.1015 - val_binary_accuracy: 0.8682
Epoch 18/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0050 - b
inary_accuracy: 0.9975 - val_loss: 0.1021 - val_binary_accuracy: 0.8681
Epoch 19/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0045 - b
inary_accuracy: 0.9975 - val_loss: 0.1031 - val_binary_accuracy: 0.8671
Epoch 20/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0042 - b
inary_accuracy: 0.9977 - val_loss: 0.1038 - val_binary_accuracy: 0.8668
```





In [85]:

```
model = models.Sequential()
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

model.fit(x_train, y_train, epochs=2, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/2
49/49 [==============================] - 1s 12ms/step - loss: 0.1373 - accu
racy: 0.8320
Epoch 2/2
49/49 [==============================] - 1s 12ms/step - loss: 0.0710 - accu
racy: 0.9183
782/782 [==============================] - 2s 3ms/step - loss: 0.0881 - acc
uracy: 0.8873
```

Out[85]:

```
[0.0880509689450264, 0.8873199820518494]
```

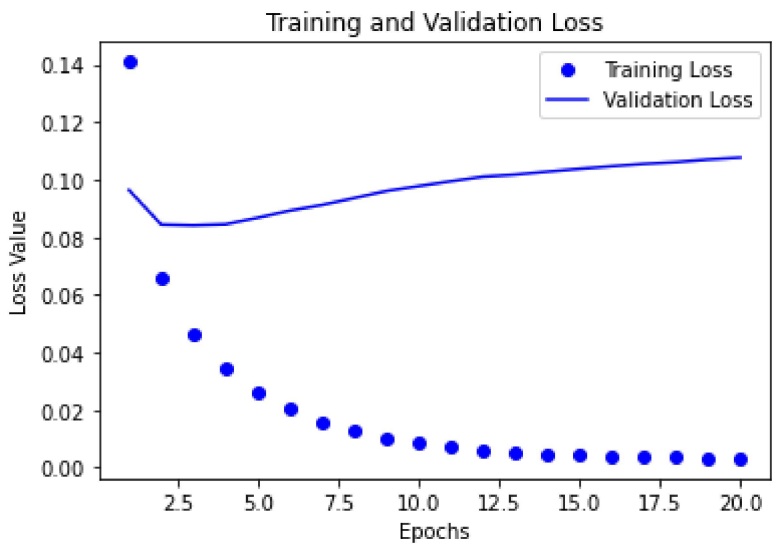
In [86]:

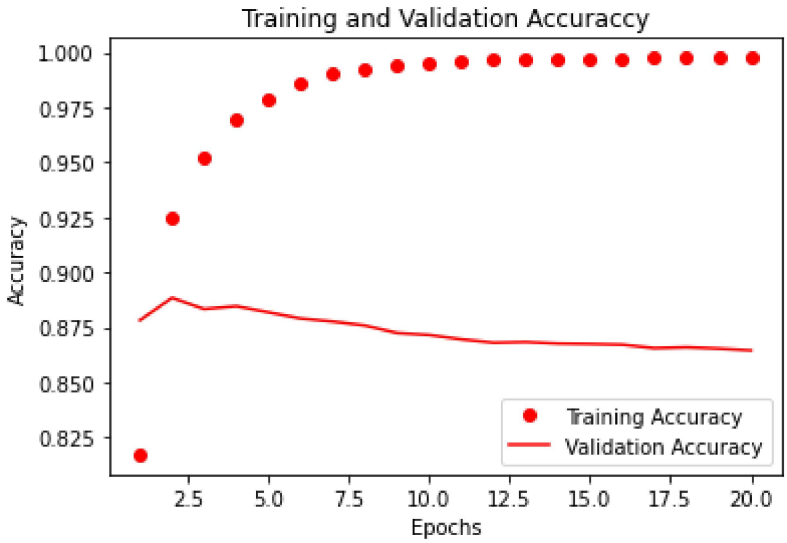
```
#implemented one hideden layer with 64 neurons and mse loss function

from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")

plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
```

```
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 3s 64ms/step - loss: 0.1410 - bina
ry_accuracy: 0.8171 - val_loss: 0.0964 - val_binary_accuracy: 0.8782
Epoch 2/20
30/30 [==============================] - 1s 38ms/step - loss: 0.0661 - bina
ry_accuracy: 0.9249 - val_loss: 0.0844 - val_binary_accuracy: 0.8884
Epoch 3/20
30/30 [==============================] - 1s 42ms/step - loss: 0.0462 - bina
ry_accuracy: 0.9521 - val_loss: 0.0842 - val_binary_accuracy: 0.8833
Epoch 4/20
30/30 [==============================] - 1s 39ms/step - loss: 0.0346 - bina
ry_accuracy: 0.9691 - val_loss: 0.0845 - val_binary_accuracy: 0.8846
Epoch 5/20
30/30 [==============================] - 1s 36ms/step - loss: 0.0263 - bina
ry_accuracy: 0.9791 - val_loss: 0.0868 - val_binary_accuracy: 0.8818
Epoch 6/20
30/30 [==============================] - 1s 34ms/step - loss: 0.0203 - bina
ry_accuracy: 0.9859 - val_loss: 0.0893 - val_binary_accuracy: 0.8790
Epoch 7/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0160 - bina
ry_accuracy: 0.9902 - val_loss: 0.0912 - val_binary_accuracy: 0.8776
Epoch 8/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0127 - bina
ry_accuracy: 0.9924 - val_loss: 0.0936 - val_binary_accuracy: 0.8758
Epoch 9/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0103 - bina
ry_accuracy: 0.9941 - val_loss: 0.0961 - val_binary_accuracy: 0.8724
Epoch 10/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0084 - bina
ry_accuracy: 0.9953 - val_loss: 0.0978 - val_binary_accuracy: 0.8715
Epoch 11/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0071 - bina
```

```
ry_accuracy: 0.9962 - val_loss: 0.0994 - val_binary_accuracy: 0.8695
Epoch 12/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0061 - bina
ry_accuracy: 0.9967 - val_loss: 0.1010 - val_binary_accuracy: 0.8680
Epoch 13/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0053 - bina
ry_accuracy: 0.9969 - val_loss: 0.1018 - val_binary_accuracy: 0.8683
Epoch 14/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0048 - bina
ry_accuracy: 0.9969 - val_loss: 0.1028 - val_binary_accuracy: 0.8676
Epoch 15/20
30/30 [==============================] - 1s 27ms/step - loss: 0.0044 - bina
ry_accuracy: 0.9971 - val_loss: 0.1038 - val_binary_accuracy: 0.8674
Epoch 16/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0040 - bina
ry_accuracy: 0.9972 - val_loss: 0.1047 - val_binary_accuracy: 0.8671
Epoch 17/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0038 - bina
ry_accuracy: 0.9975 - val_loss: 0.1055 - val_binary_accuracy: 0.8655
Epoch 18/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0035 - bina
ry_accuracy: 0.9975 - val_loss: 0.1061 - val_binary_accuracy: 0.8659
Epoch 19/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0033 - bina
ry_accuracy: 0.9976 - val_loss: 0.1070 - val_binary_accuracy: 0.8653
Epoch 20/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0032 - bina
ry_accuracy: 0.9976 - val_loss: 0.1077 - val_binary_accuracy: 0.8645
```




Training and Validation Accuraccy
1.000
0.975
0.950
0.925
0.900
0.875
0.850
0.825
Accuracy
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Epochs
Training Accuracy
Validation Accuracy

In [87]:

```
model = models.Sequential()
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])
model.fit(x_train, y_train, epochs=4, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/4
49/49 [==============================] - 2s 22ms/step - loss: 0.1198 - accu
racy: 0.8427
Epoch 2/4
49/49 [==============================] - 1s 20ms/step - loss: 0.0601 - accu
racy: 0.9273
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0452 - accu
racy: 0.9496
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0356 - accu
racy: 0.9632
782/782 [==============================] - 3s 3ms/step - loss: 0.0923 - acc
uracy: 0.8743
```

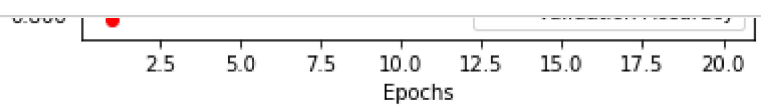
Out[87]:

```
[0.0922648012638092, 0.8742799758911133]
```

In [88]:

```
#implemented one hideden layer with 64 neurons and mse loss function

from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")

plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
```

```
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()

model = models.Sequential()
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
layers.Dropout(0.5),
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])
model.fit(x_train, y_train, epochs=4, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```




```
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1259 - a
ccuracy: 0.8396
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0623 - a
ccuracy: 0.9252
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0465 - a
ccuracy: 0.9484
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0368 - a
ccuracy: 0.9614
782/782 [==============================] - 2s 3ms/step - loss: 0.0911 -
accuracy: 0.8760
```

Out[88]:
```
[0.09106682986021042, 0.8759999871253967]
```

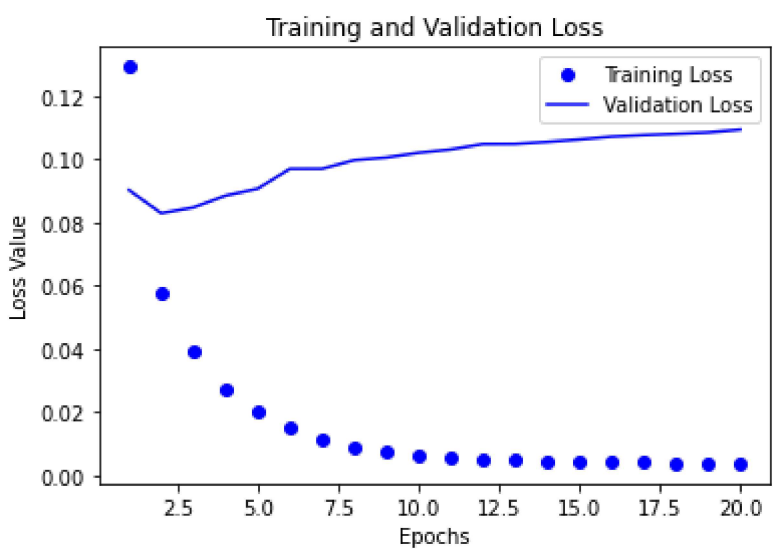
In [89]:

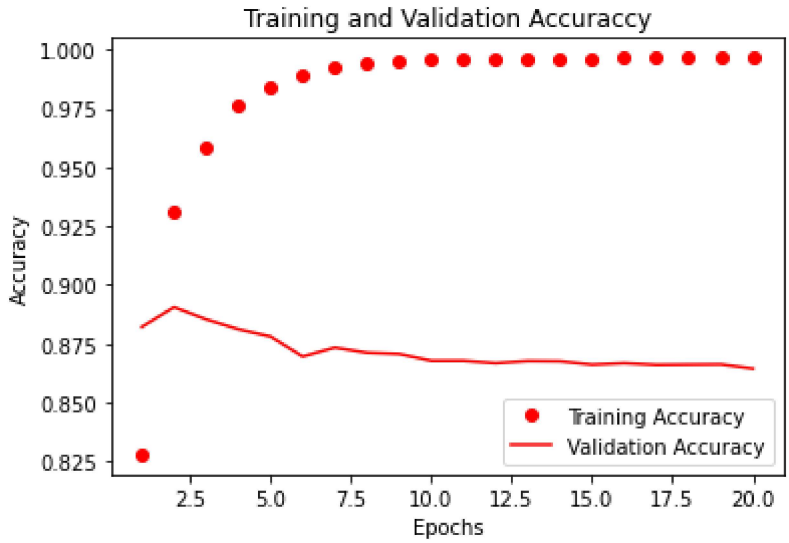
```
#implemented one hideden layer with 128 neurons and mse loss function


from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")

plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
```

```
plt.ylabel('Loss Value')
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 2s 46ms/step - loss: 0.1293 - bina
ry_accuracy: 0.8280 - val_loss: 0.0903 - val_binary_accuracy: 0.8822
Epoch 2/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0578 - bina
ry_accuracy: 0.9309 - val_loss: 0.0830 - val_binary_accuracy: 0.8906
Epoch 3/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0391 - bina
ry_accuracy: 0.9585 - val_loss: 0.0848 - val_binary_accuracy: 0.8854
Epoch 4/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0274 - bina
ry_accuracy: 0.9759 - val_loss: 0.0885 - val_binary_accuracy: 0.8812
Epoch 5/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0204 - bina
ry_accuracy: 0.9838 - val_loss: 0.0907 - val_binary_accuracy: 0.8781
Epoch 6/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0151 - bina
ry_accuracy: 0.9889 - val_loss: 0.0970 - val_binary_accuracy: 0.8696
Epoch 7/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0114 - bina
ry_accuracy: 0.9925 - val_loss: 0.0970 - val_binary_accuracy: 0.8734
Epoch 8/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0088 - bina
ry_accuracy: 0.9943 - val_loss: 0.0997 - val_binary_accuracy: 0.8712
Epoch 9/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0073 - bina
ry_accuracy: 0.9953 - val_loss: 0.1006 - val_binary_accuracy: 0.8707
Epoch 10/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0063 - bina
ry_accuracy: 0.9955 - val_loss: 0.1021 - val_binary_accuracy: 0.8678
```

```
Epoch 11/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0056 - bina
ry_accuracy: 0.9958 - val_loss: 0.1031 - val_binary_accuracy: 0.8678
Epoch 12/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0051 - bina
ry_accuracy: 0.9960 - val_loss: 0.1048 - val_binary_accuracy: 0.8668
Epoch 13/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0048 - bina
ry_accuracy: 0.9961 - val_loss: 0.1048 - val_binary_accuracy: 0.8677
Epoch 14/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0045 - bina
ry_accuracy: 0.9962 - val_loss: 0.1055 - val_binary_accuracy: 0.8676
Epoch 15/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0044 - bina
ry_accuracy: 0.9963 - val_loss: 0.1063 - val_binary_accuracy: 0.8662
Epoch 16/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0042 - bina
ry_accuracy: 0.9963 - val_loss: 0.1072 - val_binary_accuracy: 0.8668
Epoch 17/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0041 - bina
ry_accuracy: 0.9964 - val_loss: 0.1077 - val_binary_accuracy: 0.8661
Epoch 18/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0040 - bina
ry_accuracy: 0.9964 - val_loss: 0.1080 - val_binary_accuracy: 0.8662
Epoch 19/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0039 - bina
ry_accuracy: 0.9965 - val_loss: 0.1085 - val_binary_accuracy: 0.8663
Epoch 20/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0038 - bina
ry_accuracy: 0.9965 - val_loss: 0.1094 - val_binary_accuracy: 0.8645
```





In [90]:

```
model = models.Sequential()
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])
model.fit(x_train, y_train, epochs=2, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/2
49/49 [==============================] - 2s 22ms/step - loss: 0.1167 - accu
racy: 0.8446
Epoch 2/2
49/49 [==============================] - 1s 22ms/step - loss: 0.0573 - accu
racy: 0.9294
782/782 [==============================] - 3s 3ms/step - loss: 0.0884 - acc
uracy: 0.8800
```

Out[90]:

```
[0.08843938261270523, 0.8799999952316284]
```

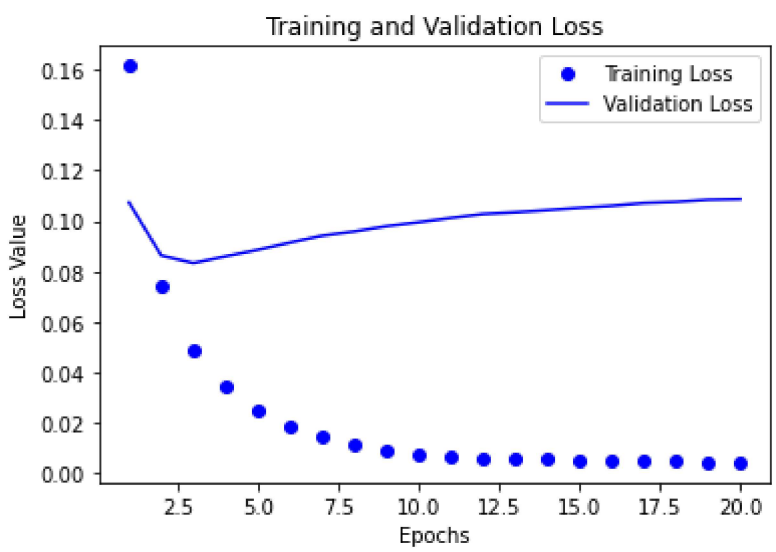
In [91]:

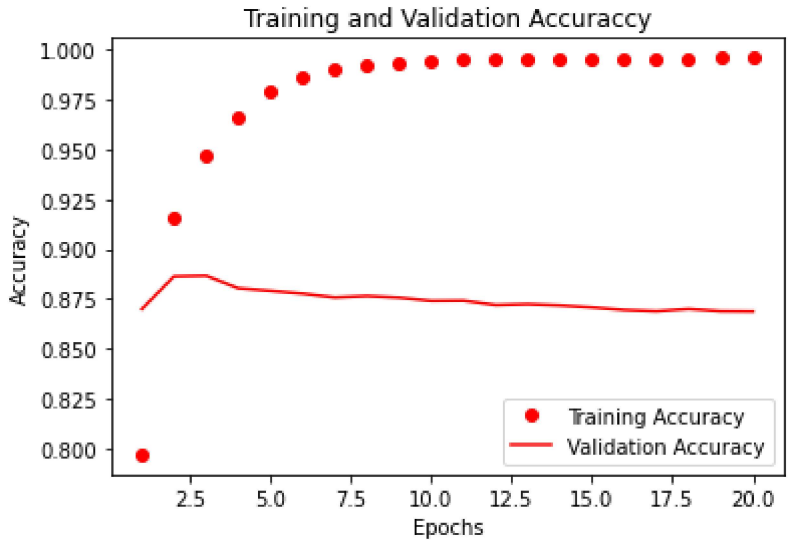
```
#implemented two hidden layer with 16 neurons and mse loss function


from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")

plt.title('Training and Validation Loss')
```

```
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 3s 59ms/step - loss: 0.1616 - b
inary_accuracy: 0.7970 - val_loss: 0.1073 - val_binary_accuracy: 0.8700
Epoch 2/20
30/30 [==============================] - 1s 23ms/step - loss: 0.0744 - b
inary_accuracy: 0.9156 - val_loss: 0.0863 - val_binary_accuracy: 0.8864
Epoch 3/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0488 - b
inary_accuracy: 0.9467 - val_loss: 0.0833 - val_binary_accuracy: 0.8867
Epoch 4/20
30/30 [==============================] - 1s 23ms/step - loss: 0.0346 - b
inary_accuracy: 0.9664 - val_loss: 0.0860 - val_binary_accuracy: 0.8804
Epoch 5/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0250 - b
inary_accuracy: 0.9787 - val_loss: 0.0886 - val_binary_accuracy: 0.8791
Epoch 6/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0187 - b
inary_accuracy: 0.9861 - val_loss: 0.0914 - val_binary_accuracy: 0.8777
Epoch 7/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0142 - b
inary_accuracy: 0.9899 - val_loss: 0.0941 - val_binary_accuracy: 0.8758
Epoch 8/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0110 - b
inary_accuracy: 0.9921 - val_loss: 0.0958 - val_binary_accuracy: 0.8765
Epoch 9/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0089 - b
inary_accuracy: 0.9937 - val_loss: 0.0979 - val_binary_accuracy: 0.8757
Epoch 10/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0075 - b
inary_accuracy: 0.9945 - val_loss: 0.0995 - val_binary_accuracy: 0.8741
```

```
Epoch 11/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0066 - b
inary_accuracy: 0.9949 - val_loss: 0.1012 - val_binary_accuracy: 0.8742
Epoch 12/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0060 - b
inary_accuracy: 0.9951 - val_loss: 0.1027 - val_binary_accuracy: 0.8720
Epoch 13/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0057 - b
inary_accuracy: 0.9952 - val_loss: 0.1034 - val_binary_accuracy: 0.8724
Epoch 14/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0054 - b
inary_accuracy: 0.9953 - val_loss: 0.1043 - val_binary_accuracy: 0.8718
Epoch 15/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0052 - b
inary_accuracy: 0.9954 - val_loss: 0.1052 - val_binary_accuracy: 0.8708
Epoch 16/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0050 - b
inary_accuracy: 0.9955 - val_loss: 0.1060 - val_binary_accuracy: 0.8695
Epoch 17/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0048 - b
inary_accuracy: 0.9956 - val_loss: 0.1071 - val_binary_accuracy: 0.8689
Epoch 18/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0046 - b
inary_accuracy: 0.9957 - val_loss: 0.1076 - val_binary_accuracy: 0.8700
Epoch 19/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0044 - b
inary_accuracy: 0.9959 - val_loss: 0.1084 - val_binary_accuracy: 0.8689
Epoch 20/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0042 - b
inary_accuracy: 0.9961 - val_loss: 0.1087 - val_binary_accuracy: 0.8688
```





In [92]:

```
model = models.Sequential()
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])
model.fit(x_train, y_train, epochs=2, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/2
49/49 [==============================] - 1s 11ms/step - loss: 0.1393 - accu
racy: 0.8234
Epoch 2/2
49/49 [==============================] - 1s 11ms/step - loss: 0.0652 - accu
racy: 0.9204
782/782 [==============================] - 2s 2ms/step - loss: 0.0854 - acc
uracy: 0.8848
```

Out[92]:

```
[0.08544862270355225, 0.8848000168800354]
```

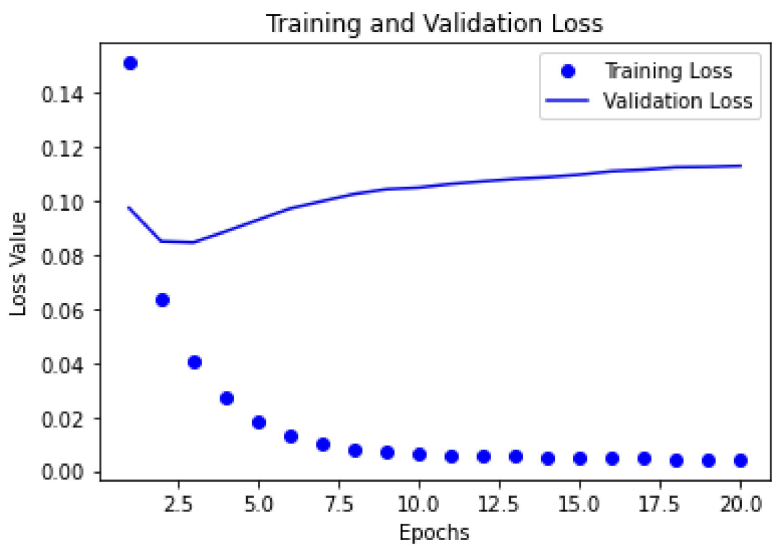
In [93]:

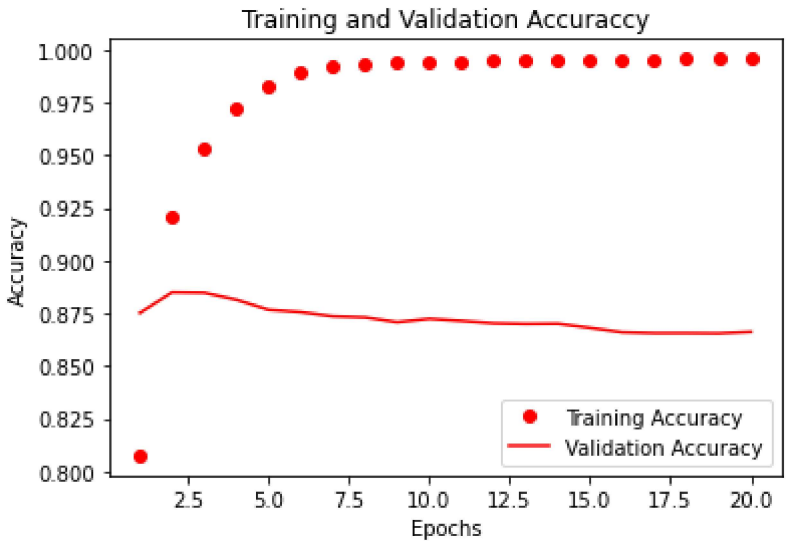
```
#implemented two hideden layer with 16 neurons and mse loss function


from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")

plt.title('Training and Validation Loss')
```

```
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 1s 30ms/step - loss: 0.1511 - bina
ry_accuracy: 0.8075 - val_loss: 0.0973 - val_binary_accuracy: 0.8752
Epoch 2/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0640 - bina
ry_accuracy: 0.9211 - val_loss: 0.0850 - val_binary_accuracy: 0.8850
Epoch 3/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0404 - bina
ry_accuracy: 0.9533 - val_loss: 0.0846 - val_binary_accuracy: 0.8848
Epoch 4/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0272 - bina
ry_accuracy: 0.9724 - val_loss: 0.0887 - val_binary_accuracy: 0.8815
Epoch 5/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0186 - bina
ry_accuracy: 0.9831 - val_loss: 0.0929 - val_binary_accuracy: 0.8767
Epoch 6/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0132 - bina
ry_accuracy: 0.9894 - val_loss: 0.0971 - val_binary_accuracy: 0.8756
Epoch 7/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0101 - bina
ry_accuracy: 0.9920 - val_loss: 0.0999 - val_binary_accuracy: 0.8736
Epoch 8/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0082 - bina
ry_accuracy: 0.9931 - val_loss: 0.1025 - val_binary_accuracy: 0.8731
Epoch 9/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0070 - bina
ry_accuracy: 0.9940 - val_loss: 0.1043 - val_binary_accuracy: 0.8708
Epoch 10/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0062 - bina
ry_accuracy: 0.9945 - val_loss: 0.1049 - val_binary_accuracy: 0.8724
Epoch 11/20
```

```
30/30 [==============================] - 1s 21ms/step - loss: 0.0058 - bina
ry_accuracy: 0.9947 - val_loss: 0.1063 - val_binary_accuracy: 0.8714
Epoch 12/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0056 - bina
ry_accuracy: 0.9947 - val_loss: 0.1072 - val_binary_accuracy: 0.8703
Epoch 13/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0054 - bina
ry_accuracy: 0.9949 - val_loss: 0.1081 - val_binary_accuracy: 0.8700
Epoch 14/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0051 - bina
ry_accuracy: 0.9951 - val_loss: 0.1088 - val_binary_accuracy: 0.8701
Epoch 15/20
30/30 [==============================] - 1s 23ms/step - loss: 0.0050 - bina
ry_accuracy: 0.9952 - val_loss: 0.1097 - val_binary_accuracy: 0.8681
Epoch 16/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0048 - bina
ry_accuracy: 0.9954 - val_loss: 0.1110 - val_binary_accuracy: 0.8660
Epoch 17/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0046 - bina
ry_accuracy: 0.9955 - val_loss: 0.1115 - val_binary_accuracy: 0.8656
Epoch 18/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0044 - bina
ry_accuracy: 0.9958 - val_loss: 0.1124 - val_binary_accuracy: 0.8656
Epoch 19/20
30/30 [==============================] - 1s 22ms/step - loss: 0.0043 - bina
ry_accuracy: 0.9959 - val_loss: 0.1126 - val_binary_accuracy: 0.8655
Epoch 20/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0042 - bina
ry_accuracy: 0.9959 - val_loss: 0.1129 - val_binary_accuracy: 0.8662
```




Training and Validation Accuraccy
1.000
0.975
0.950
0.925
0.900
0.875
0.850
0.825
0.800
Accuracy
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Epochs
Training Accuracy
Validation Accuracy

In [94]:

```
model = models.Sequential()
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])
model.fit(x_train, y_train, epochs=2, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/2
49/49 [==============================] - 1s 15ms/step - loss: 0.1265 - accu
racy: 0.8337
Epoch 2/2
49/49 [==============================] - 1s 13ms/step - loss: 0.0583 - accu
racy: 0.9260
782/782 [==============================] - 2s 3ms/step - loss: 0.0864 - acc
uracy: 0.8822
```

Out[94]:

```
[0.0864405557513237, 0.8822000026702881]
```

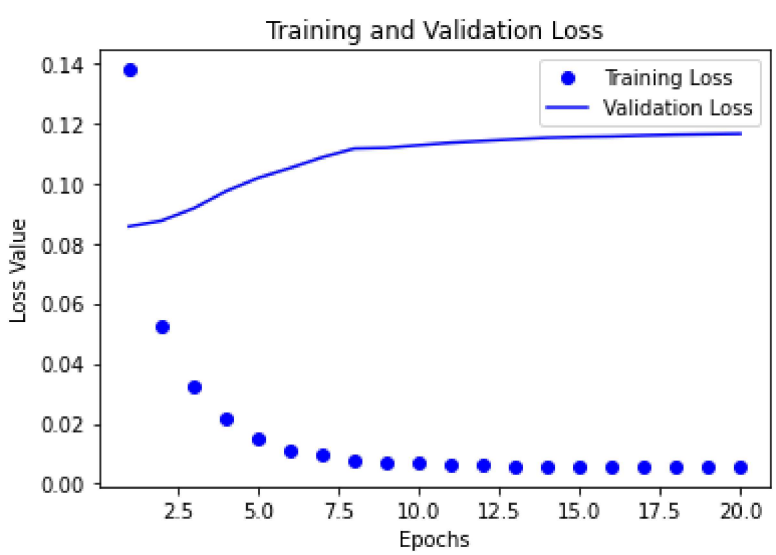
In [95]:

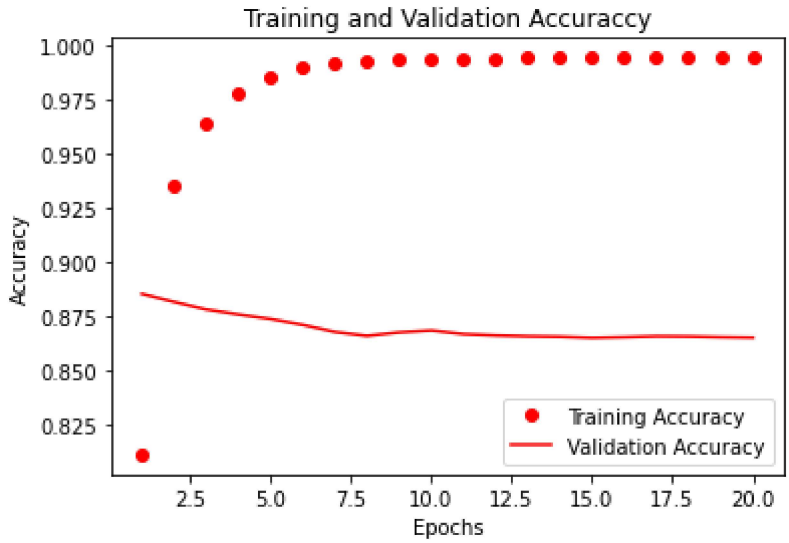
```
#implemented two hideden layer with 64 neurons and mse loss function


from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")

plt.title('Training and Validation Loss')
```

```
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 2s 59ms/step - loss: 0.1377 - bina
ry_accuracy: 0.8111 - val_loss: 0.0856 - val_binary_accuracy: 0.8853
Epoch 2/20
30/30 [==============================] - 1s 34ms/step - loss: 0.0522 - bina
ry_accuracy: 0.9351 - val_loss: 0.0875 - val_binary_accuracy: 0.8816
Epoch 3/20
30/30 [==============================] - 1s 34ms/step - loss: 0.0324 - bina
ry_accuracy: 0.9641 - val_loss: 0.0916 - val_binary_accuracy: 0.8781
Epoch 4/20
30/30 [==============================] - 1s 36ms/step - loss: 0.0214 - bina
ry_accuracy: 0.9783 - val_loss: 0.0972 - val_binary_accuracy: 0.8758
Epoch 5/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0150 - bina
ry_accuracy: 0.9857 - val_loss: 0.1017 - val_binary_accuracy: 0.8737
Epoch 6/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0112 - bina
ry_accuracy: 0.9899 - val_loss: 0.1050 - val_binary_accuracy: 0.8710
Epoch 7/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0094 - bina
ry_accuracy: 0.9917 - val_loss: 0.1086 - val_binary_accuracy: 0.8677
Epoch 8/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0079 - bina
ry_accuracy: 0.9929 - val_loss: 0.1115 - val_binary_accuracy: 0.8659
Epoch 9/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0071 - bina
ry_accuracy: 0.9933 - val_loss: 0.1117 - val_binary_accuracy: 0.8675
Epoch 10/20
30/30 [==============================] - 1s 29ms/step - loss: 0.0067 - bina
ry_accuracy: 0.9935 - val_loss: 0.1126 - val_binary_accuracy: 0.8684
Epoch 11/20
```

```
30/30 [==============================] - 1s 29ms/step - loss: 0.0063 - bina
ry_accuracy: 0.9939 - val_loss: 0.1134 - val_binary_accuracy: 0.8667
Epoch 12/20
30/30 [==============================] - 1s 29ms/step - loss: 0.0062 - bina
ry_accuracy: 0.9939 - val_loss: 0.1140 - val_binary_accuracy: 0.8661
Epoch 13/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0059 - bina
ry_accuracy: 0.9941 - val_loss: 0.1146 - val_binary_accuracy: 0.8657
Epoch 14/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0058 - bina
ry_accuracy: 0.9943 - val_loss: 0.1151 - val_binary_accuracy: 0.8655
Epoch 15/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0058 - bina
ry_accuracy: 0.9943 - val_loss: 0.1154 - val_binary_accuracy: 0.8650
Epoch 16/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0058 - bina
ry_accuracy: 0.9943 - val_loss: 0.1155 - val_binary_accuracy: 0.8653
Epoch 17/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0057 - bina
ry_accuracy: 0.9943 - val_loss: 0.1159 - val_binary_accuracy: 0.8657
Epoch 18/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0057 - bina
ry_accuracy: 0.9943 - val_loss: 0.1161 - val_binary_accuracy: 0.8656
Epoch 19/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0057 - bina
ry_accuracy: 0.9943 - val_loss: 0.1163 - val_binary_accuracy: 0.8653
Epoch 20/20
30/30 [==============================] - 1s 29ms/step - loss: 0.0057 - bina
ry_accuracy: 0.9943 - val_loss: 0.1164 - val_binary_accuracy: 0.8651
```





In [96]:

```
model = models.Sequential()
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])
model.fit(x_train, y_train, epochs=2, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/2
49/49 [==============================] - 2s 18ms/step - loss: 0.1170 - accu
racy: 0.8397
Epoch 2/2
49/49 [==============================] - 1s 18ms/step - loss: 0.0537 - accu
racy: 0.9315
782/782 [==============================] - 2s 3ms/step - loss: 0.0928 - acc
uracy: 0.8760
```

Out[96]:

```
[0.09281282126903534, 0.8759999871253967]
```

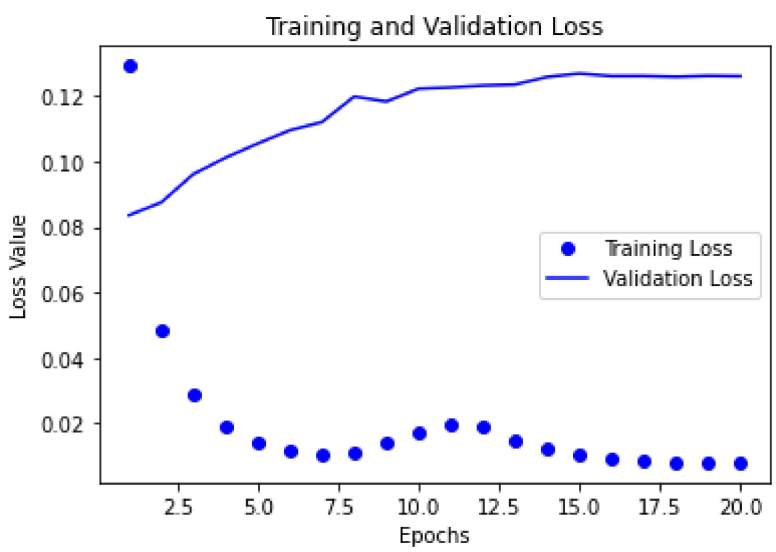
In [97]:

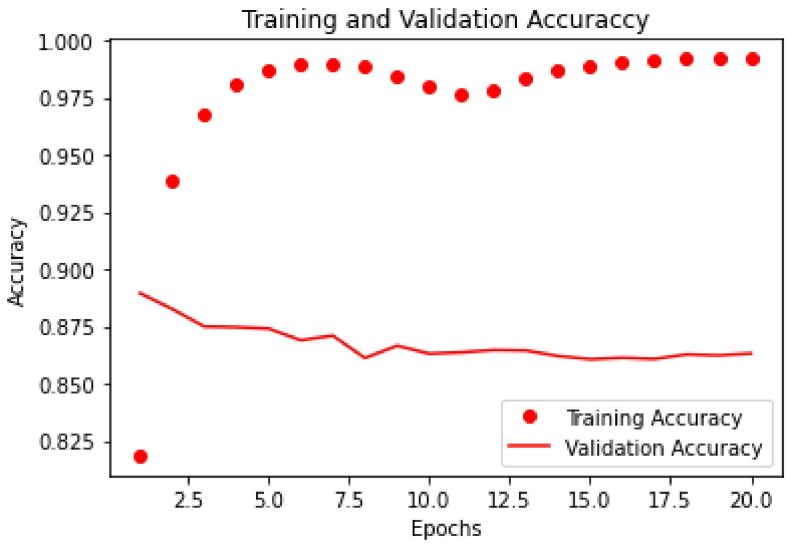
```
#implemented two hideden layer with 128 neurons and mse loss function


from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")

plt.title('Training and Validation Loss')
```

```
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 2s 42ms/step - loss: 0.1293 - b
inary_accuracy: 0.8185 - val_loss: 0.0836 - val_binary_accuracy: 0.8895
Epoch 2/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0484 - b
inary_accuracy: 0.9382 - val_loss: 0.0875 - val_binary_accuracy: 0.8826
Epoch 3/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0291 - b
inary_accuracy: 0.9677 - val_loss: 0.0962 - val_binary_accuracy: 0.8749
Epoch 4/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0188 - b
inary_accuracy: 0.9805 - val_loss: 0.1012 - val_binary_accuracy: 0.8746
Epoch 5/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0139 - b
inary_accuracy: 0.9867 - val_loss: 0.1055 - val_binary_accuracy: 0.8740
Epoch 6/20
30/30 [==============================] - 1s 34ms/step - loss: 0.0115 - b
inary_accuracy: 0.9893 - val_loss: 0.1096 - val_binary_accuracy: 0.8689
Epoch 7/20
30/30 [==============================] - 1s 34ms/step - loss: 0.0108 - b
inary_accuracy: 0.9895 - val_loss: 0.1121 - val_binary_accuracy: 0.8709
Epoch 8/20
30/30 [==============================] - 1s 34ms/step - loss: 0.0112 - b
inary_accuracy: 0.9887 - val_loss: 0.1199 - val_binary_accuracy: 0.8611
Epoch 9/20
30/30 [==============================] - 1s 34ms/step - loss: 0.0143 - b
inary_accuracy: 0.9844 - val_loss: 0.1184 - val_binary_accuracy: 0.8665
Epoch 10/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0173 - b
inary_accuracy: 0.9801 - val_loss: 0.1223 - val_binary_accuracy: 0.8630
```

```
Epoch 11/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0199 - b
inary_accuracy: 0.9761 - val_loss: 0.1227 - val_binary_accuracy: 0.8636
Epoch 12/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0188 - b
inary_accuracy: 0.9781 - val_loss: 0.1233 - val_binary_accuracy: 0.8646
Epoch 13/20
30/30 [==============================] - 1s 34ms/step - loss: 0.0146 - b
inary_accuracy: 0.9836 - val_loss: 0.1236 - val_binary_accuracy: 0.8644
Epoch 14/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0126 - b
inary_accuracy: 0.9865 - val_loss: 0.1259 - val_binary_accuracy: 0.8620
Epoch 15/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0104 - b
inary_accuracy: 0.9890 - val_loss: 0.1269 - val_binary_accuracy: 0.8606
Epoch 16/20
30/30 [==============================] - 1s 37ms/step - loss: 0.0091 - b
inary_accuracy: 0.9906 - val_loss: 0.1262 - val_binary_accuracy: 0.8612
Epoch 17/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0085 - b
inary_accuracy: 0.9916 - val_loss: 0.1262 - val_binary_accuracy: 0.8607
Epoch 18/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0082 - b
inary_accuracy: 0.9919 - val_loss: 0.1259 - val_binary_accuracy: 0.8627
Epoch 19/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0081 - b
inary_accuracy: 0.9919 - val_loss: 0.1262 - val_binary_accuracy: 0.8623
Epoch 20/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0081 - b
inary_accuracy: 0.9919 - val_loss: 0.1261 - val_binary_accuracy: 0.8631
```




Training and Validation Accuraccy
1.000
0.975
0.950
0.925
0.900
0.875
0.850
0.825
Accuracy
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Epochs
Training Accuracy
Validation Accuracy

In [98]:

```
model = models.Sequential()
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])
model.fit(x_train, y_train, epochs=2, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/2
49/49 [==============================] - 2s 23ms/step - loss: 0.1085 - accu
racy: 0.8509
Epoch 2/2
49/49 [==============================] - 1s 22ms/step - loss: 0.0525 - accu
racy: 0.9333
782/782 [==============================] - 3s 3ms/step - loss: 0.0932 - acc
uracy: 0.8767
```

Out[98]:

```
[0.09319932758808136, 0.8766800165176392]
```

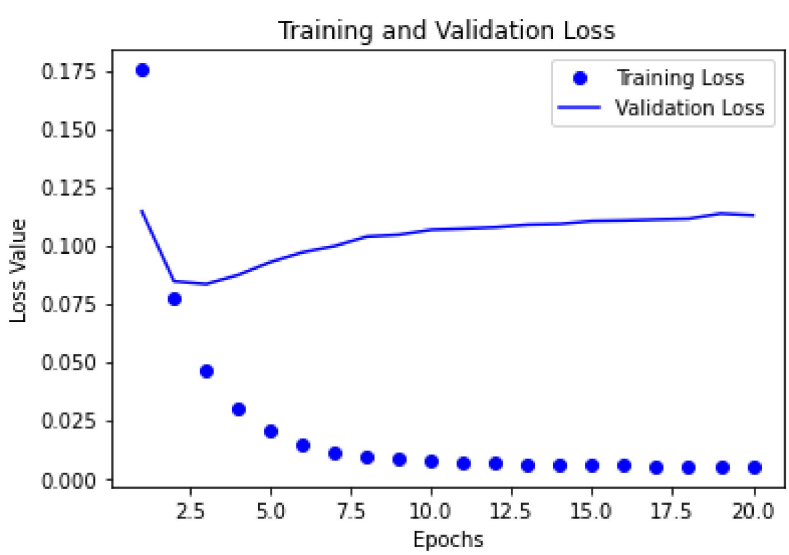
In [99]:

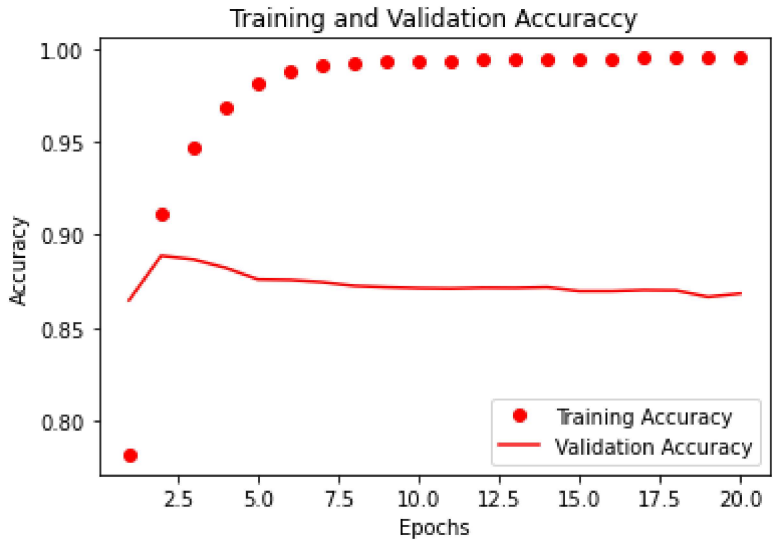
```
#implemented three hideden layer with 16 neurons and mse loss function


from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")
```

```
plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 2s 35ms/step - loss: 0.1753 - bina
ry_accuracy: 0.7819 - val_loss: 0.1144 - val_binary_accuracy: 0.8648
Epoch 2/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0774 - bina
ry_accuracy: 0.9115 - val_loss: 0.0844 - val_binary_accuracy: 0.8887
Epoch 3/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0464 - bina
ry_accuracy: 0.9473 - val_loss: 0.0832 - val_binary_accuracy: 0.8867
Epoch 4/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0302 - bina
ry_accuracy: 0.9687 - val_loss: 0.0872 - val_binary_accuracy: 0.8822
Epoch 5/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0203 - bina
ry_accuracy: 0.9818 - val_loss: 0.0927 - val_binary_accuracy: 0.8760
Epoch 6/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0146 - bina
ry_accuracy: 0.9873 - val_loss: 0.0969 - val_binary_accuracy: 0.8757
Epoch 7/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0110 - bina
ry_accuracy: 0.9906 - val_loss: 0.0996 - val_binary_accuracy: 0.8745
Epoch 8/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0090 - bina
ry_accuracy: 0.9921 - val_loss: 0.1037 - val_binary_accuracy: 0.8725
Epoch 9/20
30/30 [==============================] - 1s 17ms/step - loss: 0.0080 - bina
ry_accuracy: 0.9928 - val_loss: 0.1044 - val_binary_accuracy: 0.8718
Epoch 10/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0072 - bina
ry_accuracy: 0.9934 - val_loss: 0.1066 - val_binary_accuracy: 0.8713
Epoch 11/20
```

```
30/30 [==============================] - 1s 18ms/step - loss: 0.0067 - bina
ry_accuracy: 0.9937 - val_loss: 0.1070 - val_binary_accuracy: 0.8711
Epoch 12/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0063 - bina
ry_accuracy: 0.9940 - val_loss: 0.1076 - val_binary_accuracy: 0.8715
Epoch 13/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0061 - bina
ry_accuracy: 0.9941 - val_loss: 0.1087 - val_binary_accuracy: 0.8714
Epoch 14/20
30/30 [==============================] - 1s 17ms/step - loss: 0.0058 - bina
ry_accuracy: 0.9944 - val_loss: 0.1091 - val_binary_accuracy: 0.8718
Epoch 15/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0056 - bina
ry_accuracy: 0.9946 - val_loss: 0.1103 - val_binary_accuracy: 0.8697
Epoch 16/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0054 - bina
ry_accuracy: 0.9947 - val_loss: 0.1105 - val_binary_accuracy: 0.8697
Epoch 17/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0053 - bina
ry_accuracy: 0.9949 - val_loss: 0.1109 - val_binary_accuracy: 0.8703
Epoch 18/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0051 - bina
ry_accuracy: 0.9950 - val_loss: 0.1113 - val_binary_accuracy: 0.8701
Epoch 19/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0051 - bina
ry_accuracy: 0.9950 - val_loss: 0.1135 - val_binary_accuracy: 0.8666
Epoch 20/20
30/30 [==============================] - 1s 17ms/step - loss: 0.0049 - bina
ry_accuracy: 0.9951 - val_loss: 0.1128 - val_binary_accuracy: 0.8684
```





In [100]:

```
model = models.Sequential()
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(16, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])
model.fit(x_train, y_train, epochs=2, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/2
49/49 [==============================] - 1s 12ms/step - loss: 0.1347 - accu
racy: 0.8326
Epoch 2/2
49/49 [==============================] - 1s 11ms/step - loss: 0.0610 - accu
racy: 0.9238
782/782 [==============================] - 2s 2ms/step - loss: 0.0868 - acc
uracy: 0.8830
```

Out[100]:

```
[0.08675289899110794, 0.8829600214958191]
```

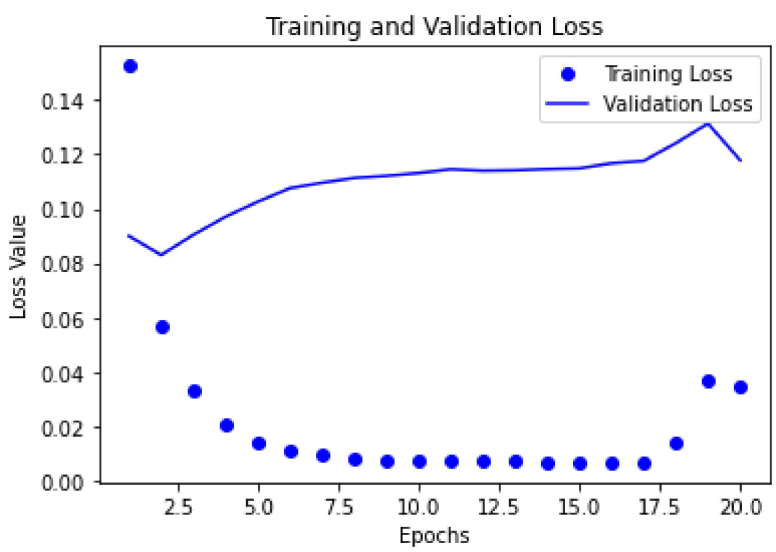
In [101]:

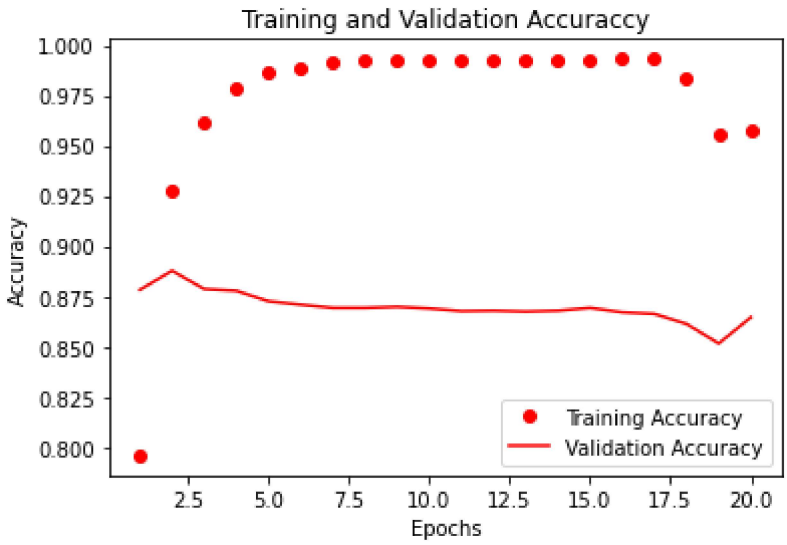
```
#implemented three hideden layer with 32 neurons and mse loss function


from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")
```

```
plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 1s 30ms/step - loss: 0.1526 - b
inary_accuracy: 0.7958 - val_loss: 0.0900 - val_binary_accuracy: 0.8783
Epoch 2/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0567 - b
inary_accuracy: 0.9279 - val_loss: 0.0830 - val_binary_accuracy: 0.8878
Epoch 3/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0329 - b
inary_accuracy: 0.9613 - val_loss: 0.0904 - val_binary_accuracy: 0.8787
Epoch 4/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0210 - b
inary_accuracy: 0.9790 - val_loss: 0.0971 - val_binary_accuracy: 0.8778
Epoch 5/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0143 - b
inary_accuracy: 0.9867 - val_loss: 0.1026 - val_binary_accuracy: 0.8726
Epoch 6/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0114 - b
inary_accuracy: 0.9891 - val_loss: 0.1076 - val_binary_accuracy: 0.8709
Epoch 7/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0094 - b
inary_accuracy: 0.9915 - val_loss: 0.1096 - val_binary_accuracy: 0.8693
Epoch 8/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0082 - b
inary_accuracy: 0.9922 - val_loss: 0.1113 - val_binary_accuracy: 0.8693
Epoch 9/20
30/30 [==============================] - 1s 18ms/step - loss: 0.0077 - b
inary_accuracy: 0.9925 - val_loss: 0.1121 - val_binary_accuracy: 0.8698
Epoch 10/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0075 - b
inary_accuracy: 0.9927 - val_loss: 0.1132 - val_binary_accuracy: 0.8690
```

```
Epoch 11/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0072 - b
inary_accuracy: 0.9929 - val_loss: 0.1145 - val_binary_accuracy: 0.8677
Epoch 12/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0071 - b
inary_accuracy: 0.9929 - val_loss: 0.1140 - val_binary_accuracy: 0.8679
Epoch 13/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0071 - b
inary_accuracy: 0.9929 - val_loss: 0.1142 - val_binary_accuracy: 0.8675
Epoch 14/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0070 - b
inary_accuracy: 0.9931 - val_loss: 0.1146 - val_binary_accuracy: 0.8679
Epoch 15/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0069 - b
inary_accuracy: 0.9931 - val_loss: 0.1149 - val_binary_accuracy: 0.8693
Epoch 16/20
30/30 [==============================] - 1s 19ms/step - loss: 0.0068 - b
inary_accuracy: 0.9933 - val_loss: 0.1168 - val_binary_accuracy: 0.8671
Epoch 17/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0067 - b
inary_accuracy: 0.9933 - val_loss: 0.1176 - val_binary_accuracy: 0.8663
Epoch 18/20
30/30 [==============================] - 1s 20ms/step - loss: 0.0138 - b
inary_accuracy: 0.9841 - val_loss: 0.1242 - val_binary_accuracy: 0.8613
Epoch 19/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0369 - b
inary_accuracy: 0.9557 - val_loss: 0.1314 - val_binary_accuracy: 0.8516
Epoch 20/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0347 - b
inary_accuracy: 0.9577 - val_loss: 0.1179 - val_binary_accuracy: 0.8646
```




Training and Validation Accuraccy
1.000
0.975
0.950
0.925
0.900
0.875
0.850
0.825
0.800
Accuracy
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Epochs
Training Accuracy
Validation Accuracy

In [102]:

```
model = models.Sequential()
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(32, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])
model.fit(x_train, y_train, epochs=2, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/2
49/49 [==============================] - 2s 13ms/step - loss: 0.1197 - accu
racy: 0.8426
Epoch 2/2
49/49 [==============================] - 1s 13ms/step - loss: 0.0551 - accu
racy: 0.9293
782/782 [==============================] - 2s 2ms/step - loss: 0.0918 - acc
uracy: 0.8772
```

Out[102]:

```
[0.09177339822053909, 0.8771600127220154]
```

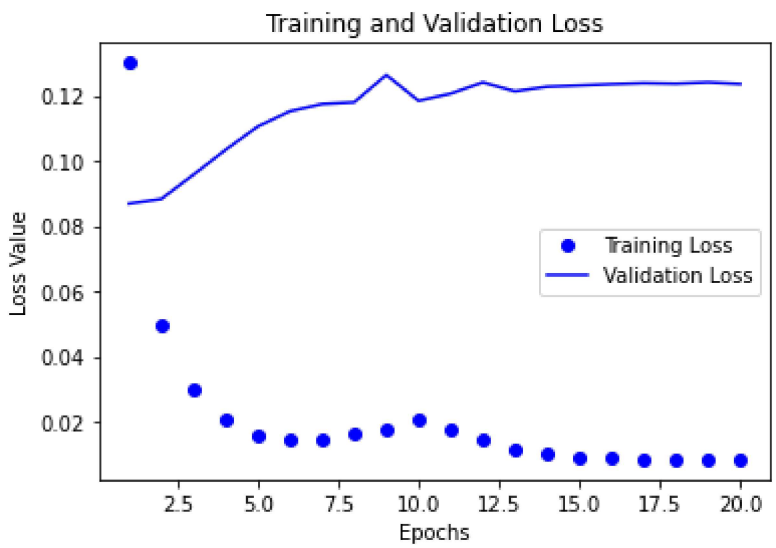
In [103]:

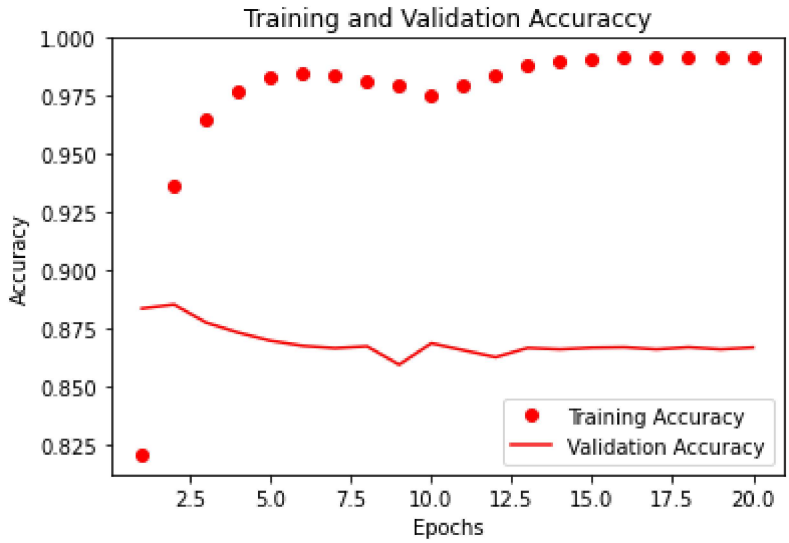
```
#implemented three hideden layer with 64 neurons and mse loss function


from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting the training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")
```

```
plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 2s 43ms/step - loss: 0.1301 - bina
ry_accuracy: 0.8207 - val_loss: 0.0869 - val_binary_accuracy: 0.8836
Epoch 2/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0497 - bina
ry_accuracy: 0.9362 - val_loss: 0.0883 - val_binary_accuracy: 0.8853
Epoch 3/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0297 - bina
ry_accuracy: 0.9651 - val_loss: 0.0957 - val_binary_accuracy: 0.8775
Epoch 4/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0205 - bina
ry_accuracy: 0.9772 - val_loss: 0.1034 - val_binary_accuracy: 0.8732
Epoch 5/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0160 - bina
ry_accuracy: 0.9833 - val_loss: 0.1105 - val_binary_accuracy: 0.8697
Epoch 6/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0147 - bina
ry_accuracy: 0.9844 - val_loss: 0.1152 - val_binary_accuracy: 0.8675
Epoch 7/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0148 - bina
ry_accuracy: 0.9837 - val_loss: 0.1174 - val_binary_accuracy: 0.8665
Epoch 8/20
30/30 [==============================] - 1s 30ms/step - loss: 0.0164 - bina
ry_accuracy: 0.9818 - val_loss: 0.1179 - val_binary_accuracy: 0.8673
Epoch 9/20
30/30 [==============================] - 1s 32ms/step - loss: 0.0174 - bina
ry_accuracy: 0.9795 - val_loss: 0.1263 - val_binary_accuracy: 0.8594
Epoch 10/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0204 - bina
ry_accuracy: 0.9755 - val_loss: 0.1184 - val_binary_accuracy: 0.8686
Epoch 11/20
```

```
30/30 [==============================] - 1s 33ms/step - loss: 0.0177 - bina
ry_accuracy: 0.9795 - val_loss: 0.1206 - val_binary_accuracy: 0.8656
Epoch 12/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0145 - bina
ry_accuracy: 0.9843 - val_loss: 0.1240 - val_binary_accuracy: 0.8626
Epoch 13/20
30/30 [==============================] - 1s 31ms/step - loss: 0.0113 - bina
ry_accuracy: 0.9885 - val_loss: 0.1213 - val_binary_accuracy: 0.8666
Epoch 14/20
30/30 [==============================] - 1s 29ms/step - loss: 0.0101 - bina
ry_accuracy: 0.9897 - val_loss: 0.1227 - val_binary_accuracy: 0.8660
Epoch 15/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0090 - bina
ry_accuracy: 0.9909 - val_loss: 0.1231 - val_binary_accuracy: 0.8667
Epoch 16/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0087 - bina
ry_accuracy: 0.9914 - val_loss: 0.1235 - val_binary_accuracy: 0.8669
Epoch 17/20
30/30 [==============================] - 1s 27ms/step - loss: 0.0087 - bina
ry_accuracy: 0.9913 - val_loss: 0.1238 - val_binary_accuracy: 0.8660
Epoch 18/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0086 - bina
ry_accuracy: 0.9914 - val_loss: 0.1236 - val_binary_accuracy: 0.8669
Epoch 19/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0085 - bina
ry_accuracy: 0.9915 - val_loss: 0.1240 - val_binary_accuracy: 0.8660
Epoch 20/20
30/30 [==============================] - 1s 27ms/step - loss: 0.0085 - bina
ry_accuracy: 0.9915 - val_loss: 0.1235 - val_binary_accuracy: 0.8668
```





In [104]:

```
model = models.Sequential()
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(64, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])
model.fit(x_train, y_train, epochs=2, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/2
49/49 [==============================] - 2s 18ms/step - loss: 0.1114 - accu
racy: 0.8484
Epoch 2/2
49/49 [==============================] - 1s 18ms/step - loss: 0.0516 - accu
racy: 0.9346
782/782 [==============================] - 2s 3ms/step - loss: 0.0945 - acc
uracy: 0.8762
```

Out[104]:

```
[0.09446453303098679, 0.8762000203132629]
```

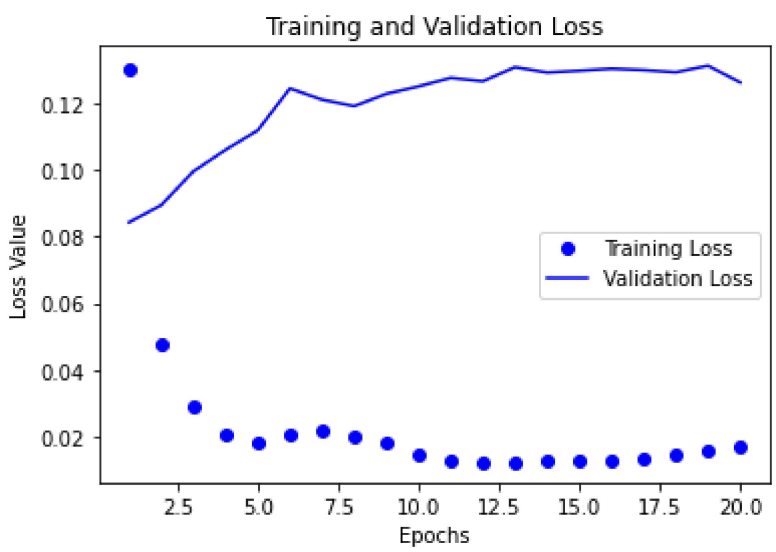
In [105]:

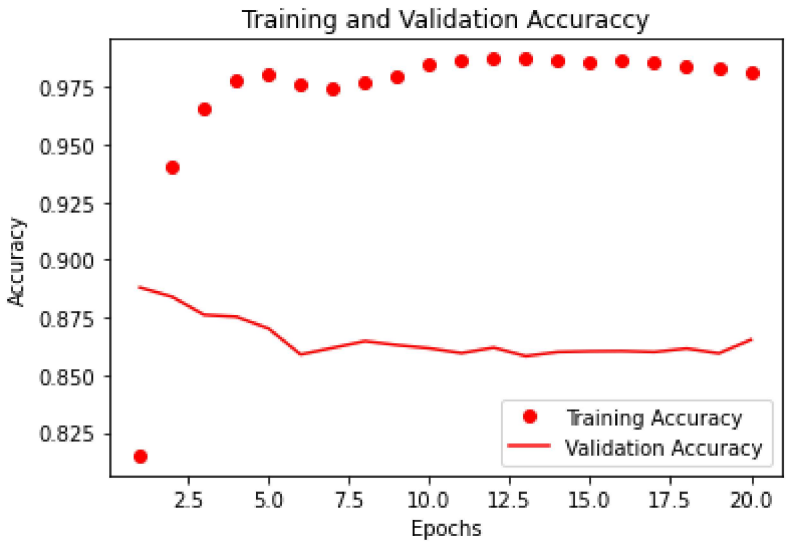
```
#implemented three hideden layer with 128 neurons and mse loss function


from keras import models
from tensorflow.keras import layers

model = models.Sequential()
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])

from keras import optimizers
from keras import losses
from keras import metrics

from tensorflow import keras
from keras import optimizers
from tensorflow.keras import optimizers
from tensorflow.keras import optimizers

model.compile(optimizer='adam',
              loss = losses.mse,
              metrics = [metrics.binary_accuracy])

x_val = x_train[:10000]
partial_x_train = x_train[10000:]

y_val = y_train[:10000]
partial_y_train = y_train[10000:]

history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))

history_dict = history.history
history_dict.keys()
# Plotting training and validation loss

import matplotlib.pyplot as plt
%matplotlib inline

loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, loss_values, 'bo', label="Training Loss")
plt.plot(epochs, val_loss_values, 'b', label="Validation Loss")
```

```
plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss Value')
plt.legend()

plt.show()


# Plotting the training and validation accuracy
# Training and Validation Accuracy

acc_values = history_dict['binary_accuracy']
val_acc_values = history_dict['val_binary_accuracy']

epochs = range(1, len(loss_values) + 1)

plt.plot(epochs, acc_values, 'ro', label="Training Accuracy")
plt.plot(epochs, val_acc_values, 'r', label="Validation Accuracy")

plt.title('Training and Validation Accuraccy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

```
Epoch 1/20
30/30 [==============================] - 2s 44ms/step - loss: 0.1303 - b
inary_accuracy: 0.8151 - val_loss: 0.0843 - val_binary_accuracy: 0.8880
Epoch 2/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0478 - b
inary_accuracy: 0.9405 - val_loss: 0.0894 - val_binary_accuracy: 0.8840
Epoch 3/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0293 - b
inary_accuracy: 0.9661 - val_loss: 0.0996 - val_binary_accuracy: 0.8761
Epoch 4/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0205 - b
inary_accuracy: 0.9783 - val_loss: 0.1061 - val_binary_accuracy: 0.8753
Epoch 5/20
30/30 [==============================] - 1s 36ms/step - loss: 0.0180 - b
inary_accuracy: 0.9808 - val_loss: 0.1119 - val_binary_accuracy: 0.8702
Epoch 6/20
30/30 [==============================] - 1s 36ms/step - loss: 0.0207 - b
inary_accuracy: 0.9763 - val_loss: 0.1245 - val_binary_accuracy: 0.8589
Epoch 7/20
30/30 [==============================] - 1s 33ms/step - loss: 0.0221 - b
inary_accuracy: 0.9743 - val_loss: 0.1211 - val_binary_accuracy: 0.8618
Epoch 8/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0202 - b
inary_accuracy: 0.9771 - val_loss: 0.1192 - val_binary_accuracy: 0.8647
Epoch 9/20
30/30 [==============================] - 1s 37ms/step - loss: 0.0183 - b
inary_accuracy: 0.9798 - val_loss: 0.1228 - val_binary_accuracy: 0.8630
Epoch 10/20
30/30 [==============================] - 1s 37ms/step - loss: 0.0146 - b
inary_accuracy: 0.9851 - val_loss: 0.1251 - val_binary_accuracy: 0.8616
```

```
Epoch 11/20
30/30 [==============================] - 1s 34ms/step - loss: 0.0128 - b
inary_accuracy: 0.9868 - val_loss: 0.1276 - val_binary_accuracy: 0.8595
Epoch 12/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0122 - b
inary_accuracy: 0.9873 - val_loss: 0.1266 - val_binary_accuracy: 0.8619
Epoch 13/20
30/30 [==============================] - 1s 39ms/step - loss: 0.0124 - b
inary_accuracy: 0.9872 - val_loss: 0.1308 - val_binary_accuracy: 0.8582
Epoch 14/20
30/30 [==============================] - 1s 40ms/step - loss: 0.0125 - b
inary_accuracy: 0.9870 - val_loss: 0.1292 - val_binary_accuracy: 0.8600
Epoch 15/20
30/30 [==============================] - 1s 39ms/step - loss: 0.0130 - b
inary_accuracy: 0.9861 - val_loss: 0.1298 - val_binary_accuracy: 0.8603
Epoch 16/20
30/30 [==============================] - 1s 37ms/step - loss: 0.0125 - b
inary_accuracy: 0.9869 - val_loss: 0.1304 - val_binary_accuracy: 0.8604
Epoch 17/20
30/30 [==============================] - 1s 34ms/step - loss: 0.0132 - b
inary_accuracy: 0.9860 - val_loss: 0.1300 - val_binary_accuracy: 0.8600
Epoch 18/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0146 - b
inary_accuracy: 0.9841 - val_loss: 0.1293 - val_binary_accuracy: 0.8615
Epoch 19/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0155 - b
inary_accuracy: 0.9829 - val_loss: 0.1313 - val_binary_accuracy: 0.8594
Epoch 20/20
30/30 [==============================] - 1s 35ms/step - loss: 0.0167 - b
inary_accuracy: 0.9811 - val_loss: 0.1263 - val_binary_accuracy: 0.8653
```




Training and Validation Accuraccy
Accuracy
0.975
0.950
0.925
0.900
0.875
0.850
0.825
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Epochs
Training Accuracy
Validation Accuracy

In [106]:

```
model = models.Sequential()
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(128, activation='tanh', input_shape=(10000,)))
model.add(layers.Dense(1, activation='sigmoid'))

model.compile(optimizer='adam',
              loss='mse',
              metrics=['accuracy'])
model.fit(x_train, y_train, epochs=2, batch_size=512)
results = model.evaluate(x_test, y_test)

results
```

```
Epoch 1/2
49/49 [==============================] - 2s 24ms/step - loss: 0.1069 - accu
racy: 0.8519
Epoch 2/2
49/49 [==============================] - 1s 23ms/step - loss: 0.0512 - accu
racy: 0.9360
782/782 [==============================] - 3s 3ms/step - loss: 0.0974 - acc
uracy: 0.8718
```

Out[106]:

```
[0.09738101810216904, 0.8717600107192993]
```

In [ ]: