In [2]:
```
# import necessary libraries:
import numpy as np
# importing keras models:
import tensorflow as tf
from keras.models import Sequential
from keras.layers import Dense
import os
import matplotlib.pyplot as plt
```

Using TensorFlow backend.

In [3]:
```
# change the working directory
os.chdir("/Users/karimaidrissi/Desktop/DSSA 5104 DL/keras/")
```

In [18]:
```
# load the dataset
features_and_targets = np.loadtxt('features_and_targets.csv',delimiter=
',')
# shuffle our dataset by using np.random
np.random.shuffle(features_and_targets)

# columns 0-4 are features
X = features_and_targets[:,0:5]
# columns 5-6 are targets
Y = features_and_targets[:,5:7]

# the random output will remain the same by using seed 10
np.random.seed(10)

# Create a simple model
model = tf.keras.models.Sequential() # intial model with Sequential mode
l type
model.add(tf.keras.layers.Dense(4,input_dim=5,activation="relu")) # full
y connect the 4 hidden layer and 5 input layers by using Dense layer
model.add(tf.keras.layers.Dense(3, activation="relu")) # using ReLu func
tion to fire the model
model.add(tf.keras.layers.Dense(2, activation="sigmoid")) # using Sigmoi
d function to activate the last two output layers
# done with the archeticture of our model we will define some paramters
 for training our model
# we will compile our model with loss function, optimizer as adam defaul
t and do the accuracy.
model.compile(loss='mean_squared_error',optimizer="adam", metrics= ["acc
uracy"])
```

In [19]:
```
# train the model by passing X and Y with 150 iteration
model.fit(X,Y, epochs=150,verbose=0)

#run and create a history object with model.fit()
history = model.fit(X,Y, epochs=150, verbose=0 )
print(history.history.keys())

# evaluate the model
val_loss, val_accuracy = model.evaluate(X,Y)
print(val_loss, val_accuracy)
# printing the accuracy of our model
print('\n%s: %.2f%%' % ( model.metrics_names[1],val_accuracy*100))
# printing the loss of our model
print('\n%s: %.2f%%' % (model.metrics_names[0], val_loss*100))

# returning the predicting model
predicted_targets = model.predict(X)
predicted_targets

# iterate by 22 times over the predicted target and the observed target
for i in range(22):
    print('Predicted: ',predicted_targets[i,:],'Observed: ',Y[i,:])
```

```
dict_keys(['loss', 'accuracy'])
22/22 [==============================] - 0s 12ms/sample - loss: 0.2130
- accuracy: 0.6364
0.21304577589035034 0.6363636

accuracy: 63.64%

loss: 21.30%
Predicted:  [0.44608557 0.6543813 ] Observed:  [1. 0.]
Predicted:  [0.436274  0.5885499] Observed:  [0. 1.]
Predicted:  [0.3161513  0.68494016] Observed:  [0. 1.]
Predicted:  [0.3723901  0.51726073] Observed:  [0. 1.]
Predicted:  [0.36497337 0.5129326 ] Observed:  [0. 1.]
Predicted:  [0.4271265 0.5481677] Observed:  [1. 0.]
Predicted:  [0.29423326 0.7019329 ] Observed:  [0. 1.]
Predicted:  [0.4214809  0.60004795] Observed:  [1. 0.]
Predicted:  [0.3841725  0.52406037] Observed:  [0. 1.]
Predicted:  [0.32450667 0.6696159 ] Observed:  [0. 1.]
Predicted:  [0.42578447 0.5474286 ] Observed:  [1. 0.]
Predicted:  [0.42790473 0.55164415] Observed:  [1. 0.]
Predicted:  [0.4271265 0.5481677] Observed:  [0. 1.]
Predicted:  [0.44002816 0.6047595 ] Observed:  [0. 1.]
Predicted:  [0.4137374  0.66538984] Observed:  [0. 1.]
Predicted:  [0.32566786 0.6868797 ] Observed:  [0. 1.]
Predicted:  [0.4271265 0.5481677] Observed:  [1. 0.]
Predicted:  [0.4271265 0.5481677] Observed:  [1. 0.]
Predicted:  [0.444914  0.6254677] Observed:  [0. 1.]
Predicted:  [0.4271265 0.5481677] Observed:  [1. 0.]
Predicted:  [0.3134087  0.70009625] Observed:  [0. 1.]
Predicted:  [0.43858957 0.59857666] Observed:  [0. 1.]
```

In [20]:
```
# list all data in history:
type(history.history)
print(history.history.keys())
# summarize history for accuracy:
print('Accuracy', history.history["accuracy"]) # print history for accur
acy
print('Loss',history.history["loss"])  # print history for loss
plt.plot(history.history["accuracy"])
plt.plot(history.history["loss"])
plt.title("model of accuracy and loss")
plt.ylabel("accuracy/loss")
plt.xlabel("epoch")
plt.legend(["accuracy", "loss"], loc="upper right")
plt.show()
```

```
dict_keys(['loss', 'accuracy'])
Accuracy [0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363
636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636,
0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.636
3636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636,
0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.636
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0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.636
3636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636,
0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.636
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0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.636
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0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.636
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0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.636
3636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636,
0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.636
3636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636,
0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.6363636, 0.636
3636, 0.6363636]
Loss [0.23667074739933014, 0.23654140532016754, 0.23641152679920197, 0.
236281156539917, 0.23615026473999023, 0.23601889610290527, 0.2358870506
286621, 0.23575474321842194, 0.23562194406986237, 0.2354886680841446,
0.23535610735416412, 0.23522800207138062, 0.2351001352071762, 0.2349714
1897678375, 0.23484177887439728, 0.23471134901046753, 0.234580099582672
12, 0.2344474196434021, 0.23431159555912018, 0.23417454957962036, 0.234
0364009141922, 0.2338971048593521, 0.23375678062438965, 0.2336154580116
272, 0.23347321152687073, 0.23333005607128143, 0.2331860065460205, 0.23
304115235805511, 0.23289543390274048, 0.23274897038936615, 0.2326017022
1328735, 0.23245373368263245, 0.23230504989624023, 0.23215560615062714,
0.232007697224617, 0.23186324536800385, 0.2317231297492981, 0.231582030
65395355, 0.2314399778842926, 0.23129697144031525, 0.23115405440330505,
0.2310139238834381, 0.23087310791015625, 0.23073157668113708, 0.2305893
450975418, 0.2304472029209137, 0.23030447959899902, 0.2301611006259918
2, 0.23001891374588013, 0.2298789918422699, 0.22973762452602386, 0.2295
9531843662262, 0.22945208847522736, 0.22930803894996643, 0.229163214564
32343, 0.22901830077171326, 0.22887301445007324, 0.22872711718082428,
0.22858065366744995, 0.22843360900878906, 0.2282860279083252, 0.2281379
5506954193, 0.22798937559127808, 0.2278403341770172, 0.2276908755302429
2, 0.22754092514514923, 0.2273905873298645, 0.22723983228206635, 0.2270
8867490291595, 0.22693711519241333, 0.22678518295288086, 0.226633071899
41406, 0.22648078203201294, 0.22632791101932526, 0.22617444396018982,
0.22602087259292603, 0.22586707770824432, 0.2257128655910492, 0.2255592
4952030182, 0.22540363669395447, 0.2252485752105713, 0.225093066692352
3, 0.22493714094161987, 0.22478117048740387, 0.22462591528892517, 0.224
46972131729126, 0.22431181371212006, 0.2241487056016922, 0.223982945084
57184, 0.2238180786371231, 0.22365230321884155, 0.22348564863204956, 0.
2233181893825531, 0.22315019369125366, 0.2229814976453781, 0.2228121161
4608765, 0.22264476120471954, 0.22247713804244995, 0.22230744361877441,
0.22213593125343323, 0.22196270525455475, 0.22178764641284943, 0.221614
40551280975, 0.2214413732290268, 0.2212674766778946, 0.2210929393768310
5, 0.2209177017211914, 0.22074176371097565, 0.22056514024734497, 0.2203
```
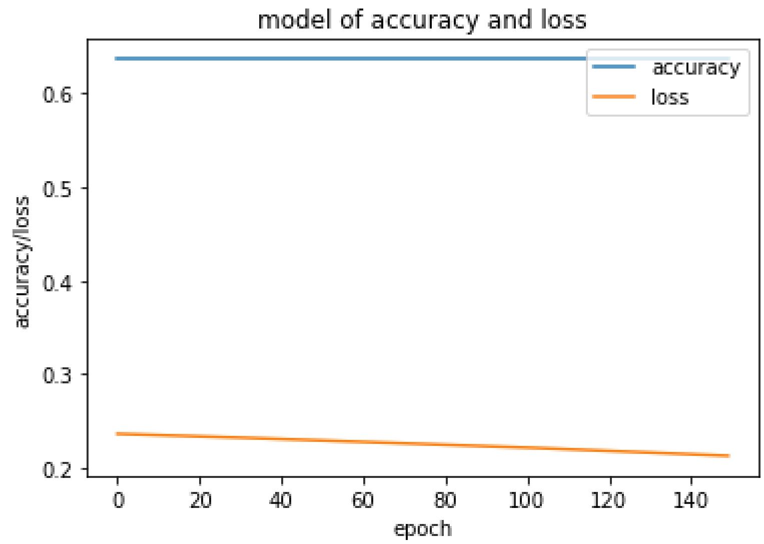
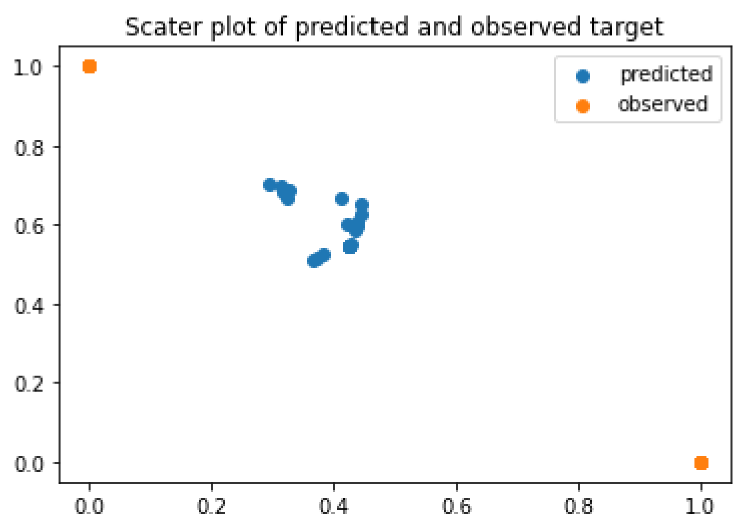

```
8960456848145, 0.2202141433954239, 0.2200366556644397, 0.2198573946952
8198, 0.21967697143554688, 0.2194986492395401, 0.21932297945022583, 0.2
1914631128311157, 0.21896880865097046, 0.21879059076309204, 0.218616619
70615387, 0.2184402495622635, 0.2182602882385254, 0.21808190643787384,
0.2179052233695984, 0.21772775053977966, 0.21754960715770721, 0.2173708
826303482, 0.2171916961669922, 0.21701480448246002, 0.2168369144201278
7, 0.21665740013122559, 0.2164769321680069, 0.216298446059227, 0.216119
4235086441, 0.2159399539232254, 0.21576005220413208, 0.2155798524618148
8, 0.2154013216495514, 0.21522097289562225, 0.2150399535894394, 0.21486
00071668625, 0.21467962861061096, 0.21449890732765198, 0.21431788802146
912, 0.21413660049438477, 0.21395502984523773, 0.2137732058763504, 0.21
359267830848694, 0.21340960264205933, 0.2132277935743332]
```




In [21]:
```python
# plotting scastter plot of predicted target and observed target
plt.scatter(predicted_targets[:,0],predicted_targets[:,1])
plt.scatter(Y[:,0],Y[:,1])
plt.title("Scater plot of predicted and observed target")
plt.legend(["predicted","observed"])
plt.show()
```



In [22]:
```
# Run this command to see if Tensorflow has detected a GPU to use
from tensorflow.python.client import device_lib
print(device_lib.list_local_devices())

#Run this - if Theano finds a GPU to use it will tell you
#import theano
```

```
[name: "/device:CPU:0"
device_type: "CPU"
memory_limit: 268435456
locality {
}
incarnation: 725552351135439036
, name: "/device:XLA_CPU:0"
device_type: "XLA_CPU"
memory_limit: 17179869184
locality {
}
incarnation: 3332633806451044665
physical_device_desc: "device: XLA_CPU device"
]
```

# epochs = 500

In [23]:
```
######################################
# train the model by passing X and Y with 500 iteration
model.fit(X,Y, epochs=500,verbose=0)

#run and create a history object with model.fit()
history = model.fit(X,Y, epochs=500, verbose=0 )
print(history.history.keys())

# evaluate the model
val_loss, val_accuracy = model.evaluate(X,Y)
print(val_loss, val_accuracy)
# printing the accuracy of our model
print('\n%s: %.2f%%' % ( model.metrics_names[1],val_accuracy*100))
# printing the loss of our model
print('\n%s: %.2f%%' % (model.metrics_names[0], val_loss*100))

# returning the predicting model
predicted_targets = model.predict(X)
predicted_targets

# iterate by 22 times over the predicted target and the observed target
for i in range(22):
    print('Predicted: ',predicted_targets[i,:],'Observed: ',Y[i,:])
```

```
dict_keys(['loss', 'accuracy'])
22/22 [==============================] - 0s 75us/sample - loss: 0.0400
- accuracy: 1.0000
0.0399923212826252 1.0

accuracy: 100.00%

loss: 4.00%
Predicted:  [0.69049716 0.3352232 ] Observed:  [1. 0.]
Predicted:  [0.04834585 0.9074958 ] Observed:  [0. 1.]
Predicted:  [0.02381992 0.9817238 ] Observed:  [0. 1.]
Predicted:  [0.04701096 0.9079255 ] Observed:  [0. 1.]
Predicted:  [0.04089212 0.9095444 ] Observed:  [0. 1.]
Predicted:  [0.69049716 0.3352232 ] Observed:  [1. 0.]
Predicted:  [0.02380996 0.98165154] Observed:  [0. 1.]
Predicted:  [0.69049716 0.3352232 ] Observed:  [1. 0.]
Predicted:  [0.04158007 0.9097821 ] Observed:  [0. 1.]
Predicted:  [0.01986909 0.98129076] Observed:  [0. 1.]
Predicted:  [0.69049716 0.3352232 ] Observed:  [1. 0.]
Predicted:  [0.69049716 0.3352232 ] Observed:  [1. 0.]
Predicted:  [0.06442876 0.90294194] Observed:  [0. 1.]
Predicted:  [0.07667875 0.9000406 ] Observed:  [0. 1.]
Predicted:  [0.0279302  0.97974086] Observed:  [0. 1.]
Predicted:  [0.02791859 0.979661  ] Observed:  [0. 1.]
Predicted:  [0.69049716 0.3352232 ] Observed:  [1. 0.]
Predicted:  [0.69049716 0.3352232 ] Observed:  [1. 0.]
Predicted:  [0.03821667 0.969257  ] Observed:  [0. 1.]
Predicted:  [0.69049716 0.3352232 ] Observed:  [1. 0.]
Predicted:  [0.02044126 0.981122  ] Observed:  [0. 1.]
Predicted:  [0.07462292 0.9005013 ] Observed:  [0. 1.]
```

In [24]:
```
# list all data in history:
type(history.history)
print(history.history.keys())
# summarize history for accuracy:
print('Accuracy', history.history["accuracy"]) # print history for accur
acy
print('Loss',history.history["loss"])  # print history for loss
plt.plot(history.history["accuracy"])
plt.plot(history.history["loss"])
plt.title("model of accuracy and loss")
plt.ylabel("accuracy/loss")
plt.xlabel("epoch")
plt.legend(["accuracy", "loss"], loc="upper right")
plt.show()
```

```
dict_keys(['loss', 'accuracy'])
Accuracy [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
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1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
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1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
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1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
Loss [0.09265302866697311, 0.0924890786409378, 0.09232135117053986, 0.0
9215123951435089, 0.09197980910539627, 0.09180658310651779, 0.091631770
13397217, 0.09145858138799667, 0.0912906900482559, 0.0911195799708366
4, 0.09095118194818497, 0.09078656882047653, 0.09062273800373077, 0.090
45049548149109, 0.0902856290340423 6, 0.09011996537446976, 0.08996994793
41507, 0.08979568630456924, 0.08963613957166672, 0.0894734188914299, 0.
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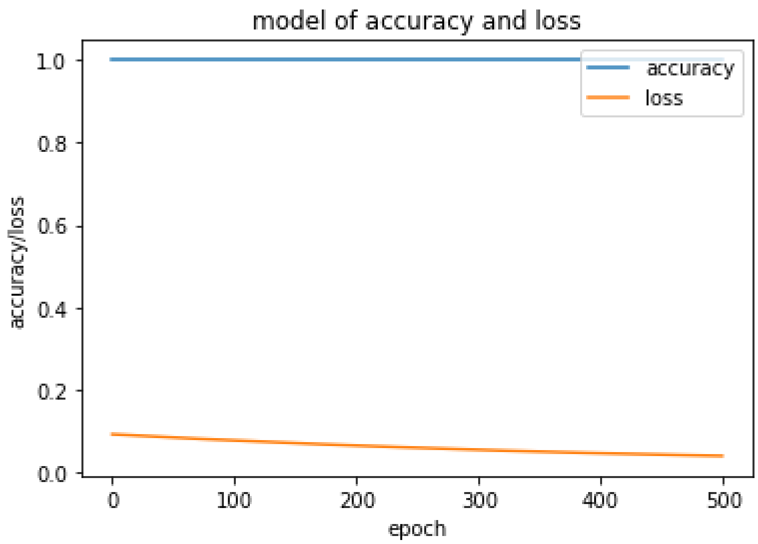
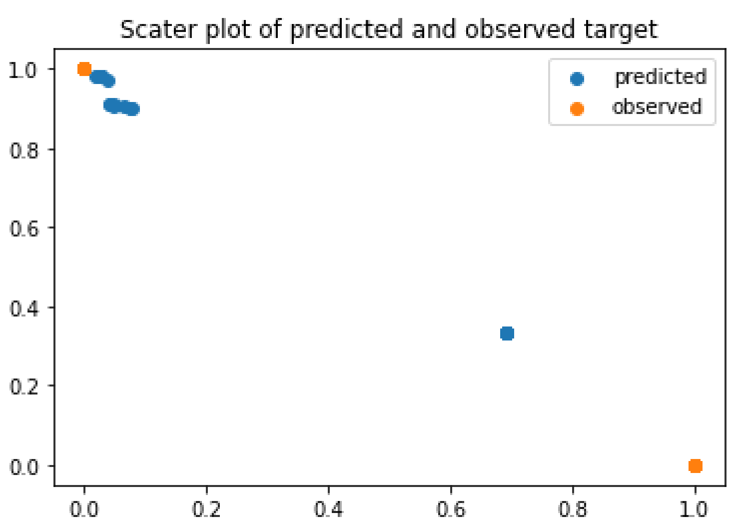
```




In [25]:
```
# plotting scastter plot of predicted target and observed target
plt.scatter(predicted_targets[:,0],predicted_targets[:,1])
plt.scatter(Y[:,0],Y[:,1])
plt.title("Scater plot of predicted and observed target")
plt.legend(["predicted","observed"])
plt.show()
```



In [26]:
```
# Run this command to see if Tensorflow has detected a GPU to use
from tensorflow.python.client import device_lib
print(device_lib.list_local_devices())

#Run this - if Theano finds a GPU to use it will tell you
#import theano
```

```
[name: "/device:CPU:0"
device_type: "CPU"
memory_limit: 268435456
locality {
}
incarnation: 5365360192848153725
, name: "/device:XLA_CPU:0"
device_type: "XLA_CPU"
memory_limit: 17179869184
locality {
}
incarnation: 11553298888453344940
physical_device_desc: "device: XLA_CPU device"
]
```

# epchos= 1500

In [27]:
```
########################################
# train the model by passing X and Y with 1500 iteration
model.fit(X,Y, epochs=1500,verbose=0)

#run and create a history object with model.fit()
history = model.fit(X,Y, epochs=1500, verbose=0 )
print(history.history.keys())

# evaluate the model
val_loss, val_accuracy = model.evaluate(X,Y)
print(val_loss, val_accuracy)
# printing the accuracy of our model
print('\n%s: %.2f%%' % ( model.metrics_names[1],val_accuracy*100))
# printing the loss of our model
print('\n%s: %.2f%%' % (model.metrics_names[0], val_loss*100))

# returning the predicting model
predicted_targets = model.predict(X)
predicted_targets

# iterate by 22 times over the predicted target and the observed target
for i in range(22):
    print('Predicted: ',predicted_targets[i,:],'Observed: ',Y[i,:])
```

```
dict_keys(['loss', 'accuracy'])
22/22 [==============================] - 0s 76us/sample - loss: 0.0030
- accuracy: 1.0000
0.0030249471310526133 1.0

accuracy: 100.00%

loss: 0.30%
Predicted:  [0.91253215 0.09362251] Observed:  [1. 0.]
Predicted:  [0.00459823 0.9912143 ] Observed:  [0. 1.]
Predicted:  [0.00686691 0.9945799 ] Observed:  [0. 1.]
Predicted:  [0.00470164 0.9911451 ] Observed:  [0. 1.]
Predicted:  [0.00560265 0.99028945] Observed:  [0. 1.]
Predicted:  [0.91253215 0.09362251] Observed:  [1. 0.]
Predicted:  [0.00673747 0.9946069 ] Observed:  [0. 1.]
Predicted:  [0.91253215 0.09362251] Observed:  [1. 0.]
Predicted:  [0.00546172 0.9904022 ] Observed:  [0. 1.]
Predicted:  [0.00540533 0.9948873 ] Observed:  [0. 1.]
Predicted:  [0.91253215 0.09362251] Observed:  [1. 0.]
Predicted:  [0.91253215 0.09362251] Observed:  [1. 0.]
Predicted:  [0.01143452 0.9843258 ] Observed:  [0. 1.]
Predicted:  [0.00786737 0.9878006 ] Observed:  [0. 1.]
Predicted:  [0.00767107 0.9943975 ] Observed:  [0. 1.]
Predicted:  [0.00752659 0.9944254 ] Observed:  [0. 1.]
Predicted:  [0.91253215 0.09362251] Observed:  [1. 0.]
Predicted:  [0.91253215 0.09362251] Observed:  [1. 0.]
Predicted:  [0.00643578 0.9948291 ] Observed:  [0. 1.]
Predicted:  [0.91253215 0.09362251] Observed:  [1. 0.]
Predicted:  [0.00530329 0.99491274] Observed:  [0. 1.]
Predicted:  [0.00835794 0.98729926] Observed:  [0. 1.]
```

In [28]:
```
# list all data in history:
type(history.history)
print(history.history.keys())
# summarize history for accuracy:
print('Accuracy', history.history["accuracy"]) # print history for accur
acy
print('Loss',history.history["loss"])  # print history for loss
plt.plot(history.history["accuracy"])
plt.plot(history.history["loss"])
plt.title("model of accuracy and loss")
plt.ylabel("accuracy/loss")
plt.xlabel("epoch")
plt.legend(["accuracy", "loss"], loc="upper right")
plt.show()
```

```
dict_keys(['loss', 'accuracy'])
Accuracy [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
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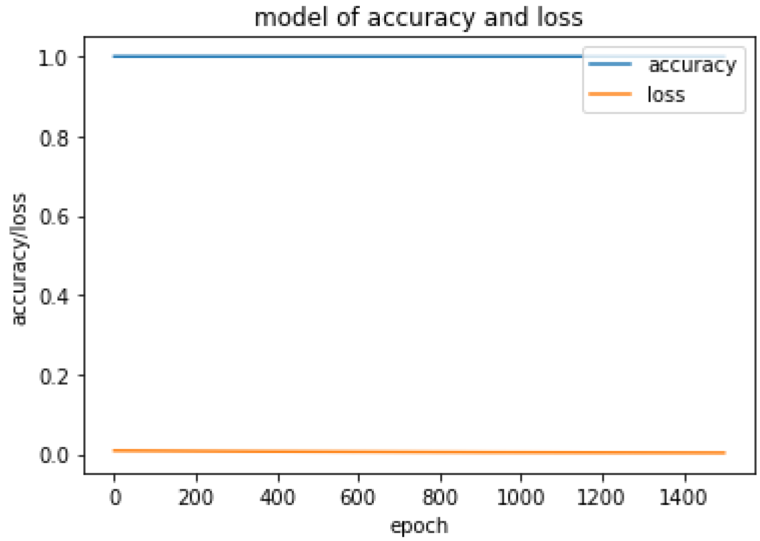
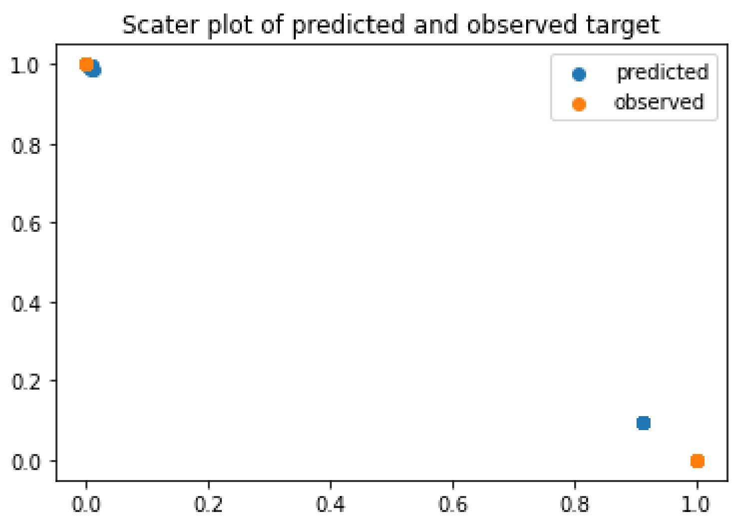



In [29]:
```
# plotting scastter plot of predicted target and observed target
plt.scatter(predicted_targets[:,0],predicted_targets[:,1])
plt.scatter(Y[:,0],Y[:,1])
plt.title("Scater plot of predicted and observed target")
plt.legend(["predicted","observed"])
plt.show()
```



In [30]:
```
# Run this command to see if Tensorflow has detected a GPU to use
from tensorflow.python.client import device_lib
print(device_lib.list_local_devices())

#Run this - if Theano finds a GPU to use it will tell you
#import theano
```

```
[name: "/device:CPU:0"
device_type: "CPU"
memory_limit: 268435456
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}
incarnation: 17494523589789408744
, name: "/device:XLA_CPU:0"
device_type: "XLA_CPU"
memory_limit: 17179869184
locality {
}
incarnation: 16852421481777283151
physical_device_desc: "device: XLA_CPU device"
]
```

COMMENT: We conclude by increasing the number of epochs the accuracy result become more accurate and the loss rate goes down.