In [ ]:
```
# Name : Shubham Sapkal
# Roll No. : 2012118
# subject: ML DL
# practical no. : 10 (A)
```

Import Libraries

In [ ]:
```
import pandas as pd
from keras.layers import Dense
from keras.models import Sequential
```

Loading The DataSets

In [ ]:
```
df = pd.read_csv('diabetes.csv')
```

In [ ]:
```
df.head()
```

Out[ ]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction
0	6	148	72	35	0	33.6	0.627
1	1	85	66	29	0	26.6	0.351
2	8	183	64	0	0	23.3	0.672
3	1	89	66	23	94	28.1	0.167
4	0	137	40	35	168	43.1	2.288

Spliting The DataSet

In [ ]:
```
x = df.drop('Outcome',axis=1)
y = df['Outcome']
```

Building The Keras Model

In [ ]:
```
model = Sequential()
model.add(Dense(12,input_dim=8,activation='relu'))
model.add(Dense(12,activation='relu'))
model.add(Dense(1,activation='sigmoid'))
model.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accuracy'])
```

Fitting The Model

In [ ]:
```
model.fit(x,y,epochs=150,batch_size=10)
```

```
Epoch 1/150
77/77 [==============================] - 5s 4ms/step - loss: 5.3189 - accuracy: 0.6198
Epoch 2/150
77/77 [==============================] - 0s 3ms/step - loss: 1.8593 - accuracy: 0.6393
Epoch 3/150
77/77 [==============================] - 0s 3ms/step - loss: 0.9963 - accuracy: 0.6484
Epoch 4/150
77/77 [==============================] - 0s 3ms/step - loss: 0.7566 - accuracy: 0.6536
Epoch 5/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6862 - accuracy: 0.6810
Epoch 6/150
77/77 [==============================] - 0s 4ms/step - loss: 0.6737 - accuracy: 0.6771
Epoch 7/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6299 - accuracy: 0.6901
Epoch 8/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6265 - accuracy: 0.6797
Epoch 9/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6248 - accuracy: 0.6953
Epoch 10/150
77/77 [==============================] - 0s 5ms/step - loss: 0.6159 - accuracy: 0.6810
Epoch 11/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5989 - accuracy: 0.7031
Epoch 12/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5895 - accuracy: 0.7031
Epoch 13/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5993 - accuracy: 0.6862
Epoch 14/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5918 - accuracy: 0.6914
Epoch 15/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6369 - accuracy: 0.6927
Epoch 16/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5855 - accuracy: 0.6953
Epoch 17/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5753 - accuracy: 0.7031
Epoch 18/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5781 - accuracy: 0.7005
Epoch 19/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5762 - accuracy: 0.7122
Epoch 20/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5964 - accuracy: 0.6953
Epoch 21/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5673 - accuracy: 0.7031
Epoch 22/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5773 - accuracy: 0.7005
Epoch 23/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5841 - accuracy: 0.7005
Epoch 24/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5780 - accuracy: 0.7057
Epoch 25/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5748 - accuracy: 0.6966
Epoch 26/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5906 - accuracy: 0.7070
Epoch 27/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5920 - accuracy: 0.7135
Epoch 28/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5777 - accuracy: 0.7148
Epoch 29/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5605 - accuracy: 0.7240
Epoch 30/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5666 - accuracy: 0.7240
Epoch 31/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5777 - accuracy: 0.7279
Epoch 32/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5394 - accuracy: 0.7422
```

```
Epoch 33/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5602 - accuracy: 0.7161
Epoch 34/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5599 - accuracy: 0.7122
Epoch 35/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5545 - accuracy: 0.7188
Epoch 36/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5606 - accuracy: 0.7161
Epoch 37/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5607 - accuracy: 0.7122
Epoch 38/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5644 - accuracy: 0.7109
Epoch 39/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5628 - accuracy: 0.7083
Epoch 40/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5604 - accuracy: 0.7318
Epoch 41/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5566 - accuracy: 0.7201
Epoch 42/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5448 - accuracy: 0.7214
Epoch 43/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5427 - accuracy: 0.7188
Epoch 44/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5371 - accuracy: 0.7240
Epoch 45/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5422 - accuracy: 0.7227
Epoch 46/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5618 - accuracy: 0.7057
Epoch 47/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5865 - accuracy: 0.7227
Epoch 48/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5587 - accuracy: 0.7331
Epoch 49/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5605 - accuracy: 0.7227
Epoch 50/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5392 - accuracy: 0.7214
Epoch 51/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5427 - accuracy: 0.7174
Epoch 52/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5405 - accuracy: 0.7266
Epoch 53/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5606 - accuracy: 0.7201
Epoch 54/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5466 - accuracy: 0.7344
Epoch 55/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5551 - accuracy: 0.7266
Epoch 56/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5373 - accuracy: 0.7344
Epoch 57/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5439 - accuracy: 0.7253
Epoch 58/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5484 - accuracy: 0.7318
Epoch 59/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5447 - accuracy: 0.7240
Epoch 60/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5596 - accuracy: 0.7122
Epoch 61/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5542 - accuracy: 0.7227
Epoch 62/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5431 - accuracy: 0.7240
Epoch 63/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5305 - accuracy: 0.7422
Epoch 64/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5489 - accuracy: 0.7422
```

```
Epoch 65/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5405 - accuracy: 0.7279
Epoch 66/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5360 - accuracy: 0.7422
Epoch 67/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5408 - accuracy: 0.7161
Epoch 68/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5287 - accuracy: 0.7331
Epoch 69/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5287 - accuracy: 0.7435
Epoch 70/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5386 - accuracy: 0.7357
Epoch 71/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5595 - accuracy: 0.7201
Epoch 72/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5245 - accuracy: 0.7448
Epoch 73/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5513 - accuracy: 0.7266
Epoch 74/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5320 - accuracy: 0.7370
Epoch 75/150
77/77 [==============================] - 0s 5ms/step - loss: 0.5299 - accuracy: 0.7448
Epoch 76/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5334 - accuracy: 0.7409
Epoch 77/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5400 - accuracy: 0.7344
Epoch 78/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5505 - accuracy: 0.7279
Epoch 79/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5144 - accuracy: 0.7422
Epoch 80/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5388 - accuracy: 0.7279
Epoch 81/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5335 - accuracy: 0.7344
Epoch 82/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5136 - accuracy: 0.7357
Epoch 83/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5077 - accuracy: 0.7591
Epoch 84/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5195 - accuracy: 0.7409
Epoch 85/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5364 - accuracy: 0.7409
Epoch 86/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5318 - accuracy: 0.7148
Epoch 87/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5325 - accuracy: 0.7396
Epoch 88/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5290 - accuracy: 0.7526
Epoch 89/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5251 - accuracy: 0.7487
Epoch 90/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5173 - accuracy: 0.7435
Epoch 91/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5243 - accuracy: 0.7409
Epoch 92/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5203 - accuracy: 0.7487
Epoch 93/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5166 - accuracy: 0.7500
Epoch 94/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5242 - accuracy: 0.7461
Epoch 95/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5168 - accuracy: 0.7474
Epoch 96/150
77/77 [==============================] - 0s 5ms/step - loss: 0.5248 - accuracy: 0.7344
```

```
Epoch 97/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5234 - accuracy: 0.7448
Epoch 98/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5136 - accuracy: 0.7578
Epoch 99/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5209 - accuracy: 0.7396
Epoch 100/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5107 - accuracy: 0.7435
Epoch 101/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5165 - accuracy: 0.7448
Epoch 102/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5341 - accuracy: 0.7357
Epoch 103/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5198 - accuracy: 0.7448
Epoch 104/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5173 - accuracy: 0.7305
Epoch 105/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5033 - accuracy: 0.7370
Epoch 106/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5203 - accuracy: 0.7513
Epoch 107/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5119 - accuracy: 0.7435
Epoch 108/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5181 - accuracy: 0.7461
Epoch 109/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4988 - accuracy: 0.7565
Epoch 110/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5174 - accuracy: 0.7500
Epoch 111/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5053 - accuracy: 0.7526
Epoch 112/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5184 - accuracy: 0.7383
Epoch 113/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5044 - accuracy: 0.7591
Epoch 114/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4935 - accuracy: 0.7500
Epoch 115/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5012 - accuracy: 0.7591
Epoch 116/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5146 - accuracy: 0.7461
Epoch 117/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5058 - accuracy: 0.7526
Epoch 118/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5128 - accuracy: 0.7422
Epoch 119/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5135 - accuracy: 0.7539
Epoch 120/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5139 - accuracy: 0.7435
Epoch 121/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5152 - accuracy: 0.7305
Epoch 122/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5085 - accuracy: 0.7422
Epoch 123/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5108 - accuracy: 0.7448
Epoch 124/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5032 - accuracy: 0.7578
Epoch 125/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5096 - accuracy: 0.7591
Epoch 126/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4952 - accuracy: 0.7708
Epoch 127/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5103 - accuracy: 0.7487
Epoch 128/150
77/77 [==============================] - 0s 4ms/step - loss: 0.4945 - accuracy: 0.7682
```

```
Epoch 129/150
77/77 [==============================] - 0s 4ms/step - loss: 0.4953 - accuracy: 0.7669
Epoch 130/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5073 - accuracy: 0.7565
Epoch 131/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4996 - accuracy: 0.7526
Epoch 132/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5005 - accuracy: 0.7500
Epoch 133/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5046 - accuracy: 0.7487
Epoch 134/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5039 - accuracy: 0.7526
Epoch 135/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4998 - accuracy: 0.7604
Epoch 136/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4962 - accuracy: 0.7513
Epoch 137/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5058 - accuracy: 0.7461
Epoch 138/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4926 - accuracy: 0.7591
Epoch 139/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4987 - accuracy: 0.7448
Epoch 140/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4932 - accuracy: 0.7669
Epoch 141/150
77/77 [==============================] - 0s 4ms/step - loss: 0.4867 - accuracy: 0.7760
Epoch 142/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5006 - accuracy: 0.7669
Epoch 143/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4926 - accuracy: 0.7643
Epoch 144/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5137 - accuracy: 0.7422
Epoch 145/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4867 - accuracy: 0.7669
Epoch 146/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4846 - accuracy: 0.7617
Epoch 147/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5015 - accuracy: 0.7656
Epoch 148/150
77/77 [==============================] - 0s 3ms/step - loss: 0.4984 - accuracy: 0.7565
Epoch 149/150
77/77 [==============================] - 0s 4ms/step - loss: 0.4957 - accuracy: 0.7552
Epoch 150/150
77/77 [==============================] - 0s 4ms/step - loss: 0.4954 - accuracy: 0.7721
```

Out[ ]:
```
<keras.callbacks.History at 0x1f42bcf1840>
```

In [ ]:
```
_,accuracy = model.evaluate(x,y)

print('Model Accuracy: %.2f'%(accuracy*100))
```

```
24/24 [==============================] - 1s 3ms/step - loss: 0.5139 - accuracy: 0.7396
Model Accuracy: 73.96
```

In [ ]:
```
predictions = model.predict(x)
print([round(x[0]) for x in predictions])
```

```
[1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0,
0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0,
0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0,
0, 0, 0, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
1, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0,
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0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0,
0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0,
0, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1,
0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,
0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0, 0, 0,
0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0,
1, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0]
```

In [ ]:
```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 12)                108

 dense_1 (Dense)             (None, 12)                156

 dense_2 (Dense)             (None, 1)                 13

=================================================================
Total params: 277
Trainable params: 277
Non-trainable params: 0
_________________________________________________________________
```

In [ ]:
```
# Name : Shubham Sapkal
# Roll No. : 2012118
# subject: ML DL
# practical no. : 10 (B)
```

Importing The Libraries

In [ ]:
```
from numpy import loadtxt
from keras.models import Sequential
from keras.layers import Dense
```

Load The DataSets

In [ ]:
```
dataset = loadtxt('pima-indians-diabetes.csv',delimiter=',')
```

In [ ]:
```
dataset
```

Out[ ]:
```
array([[  6.   , 148.   ,  72.   , ...,   0.627,  50.   ,   1.   ],
       [  1.   ,  85.   ,  66.   , ...,   0.351,  31.   ,   0.   ],
       [  8.   , 183.   ,  64.   , ...,   0.672,  32.   ,   1.   ],
       ...,
       [  5.   , 121.   ,  72.   , ...,   0.245,  30.   ,   0.   ],
       [  1.   , 126.   ,  60.   , ...,   0.349,  47.   ,   1.   ],
       [  1.   ,  93.   ,  70.   , ...,   0.315,  23.   ,   0.   ]])
```

Split Into Input (X) and Output (y) Variable

In [ ]:
```
X = dataset[:,0:8]
y = dataset[:,8]
```

Define The Keras Model

In [ ]:
```
model = Sequential()
```

In [ ]:
```
model.add(Dense(12,input_dim=8,activation='relu'))
model.add(Dense(8,activation='relu'))
model.add(Dense(1,activation='sigmoid'))
model.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accuracy'])
```

Fit The Keras Model In DataSet

In [ ]:
```
model.fit(X,y,epochs=150,batch_size=10)
```

```
Epoch 1/150
77/77 [==============================] - 5s 4ms/step - loss: 6.3282 - accuracy: 0.4805
Epoch 2/150
77/77 [==============================] - 0s 3ms/step - loss: 1.3042 - accuracy: 0.6198
Epoch 3/150
77/77 [==============================] - 0s 3ms/step - loss: 0.8671 - accuracy: 0.6367
Epoch 4/150
77/77 [==============================] - 0s 3ms/step - loss: 0.7161 - accuracy: 0.6497
Epoch 5/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6820 - accuracy: 0.6602
Epoch 6/150
77/77 [==============================] - 0s 4ms/step - loss: 0.6658 - accuracy: 0.6523
Epoch 7/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6629 - accuracy: 0.6549
Epoch 8/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6428 - accuracy: 0.6536
Epoch 9/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6355 - accuracy: 0.6732
Epoch 10/150
77/77 [==============================] - 0s 5ms/step - loss: 0.6404 - accuracy: 0.6693
Epoch 11/150
77/77 [==============================] - 0s 4ms/step - loss: 0.6343 - accuracy: 0.6706
Epoch 12/150
77/77 [==============================] - 0s 4ms/step - loss: 0.6282 - accuracy: 0.6719
Epoch 13/150
77/77 [==============================] - 0s 4ms/step - loss: 0.6201 - accuracy: 0.6628
Epoch 14/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6228 - accuracy: 0.6732
Epoch 15/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6149 - accuracy: 0.6732
Epoch 16/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6131 - accuracy: 0.6745
Epoch 17/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6122 - accuracy: 0.6732
Epoch 18/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6003 - accuracy: 0.6875
Epoch 19/150
77/77 [==============================] - 0s 3ms/step - loss: 0.6013 - accuracy: 0.6810
Epoch 20/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5959 - accuracy: 0.6771
Epoch 21/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5968 - accuracy: 0.6849
Epoch 22/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5935 - accuracy: 0.6888
Epoch 23/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5992 - accuracy: 0.6810
Epoch 24/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5928 - accuracy: 0.6927
Epoch 25/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5929 - accuracy: 0.6862
Epoch 26/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5937 - accuracy: 0.6810
Epoch 27/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5872 - accuracy: 0.6836
Epoch 28/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5872 - accuracy: 0.6927
Epoch 29/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5852 - accuracy: 0.6836
Epoch 30/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5882 - accuracy: 0.6771
Epoch 31/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5840 - accuracy: 0.6901
Epoch 32/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5806 - accuracy: 0.6875
```

```
Epoch 33/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5860 - accuracy: 0.6888
Epoch 34/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5821 - accuracy: 0.6953
Epoch 35/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5859 - accuracy: 0.6888
Epoch 36/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5821 - accuracy: 0.6836
Epoch 37/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5794 - accuracy: 0.6940
Epoch 38/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5806 - accuracy: 0.6901
Epoch 39/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5829 - accuracy: 0.6901
Epoch 40/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5794 - accuracy: 0.6927
Epoch 41/150
77/77 [==============================] - 0s 5ms/step - loss: 0.5798 - accuracy: 0.6914
Epoch 42/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5781 - accuracy: 0.6914
Epoch 43/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5862 - accuracy: 0.6888
Epoch 44/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5812 - accuracy: 0.6901
Epoch 45/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5774 - accuracy: 0.6901
Epoch 46/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5847 - accuracy: 0.6901
Epoch 47/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5778 - accuracy: 0.6914
Epoch 48/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5786 - accuracy: 0.6927
Epoch 49/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5788 - accuracy: 0.6862
Epoch 50/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5764 - accuracy: 0.6953
Epoch 51/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5801 - accuracy: 0.6901
Epoch 52/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5796 - accuracy: 0.6927
Epoch 53/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5782 - accuracy: 0.6901
Epoch 54/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5775 - accuracy: 0.6940
Epoch 55/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5735 - accuracy: 0.6966
Epoch 56/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5779 - accuracy: 0.6875
Epoch 57/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5779 - accuracy: 0.6862
Epoch 58/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5717 - accuracy: 0.6953
Epoch 59/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5723 - accuracy: 0.6901
Epoch 60/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5702 - accuracy: 0.7031
Epoch 61/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5739 - accuracy: 0.6940
Epoch 62/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5703 - accuracy: 0.6992
Epoch 63/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5803 - accuracy: 0.6875
Epoch 64/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5733 - accuracy: 0.6992
```

```
Epoch 65/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5707 - accuracy: 0.6953
Epoch 66/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5725 - accuracy: 0.6966
Epoch 67/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5730 - accuracy: 0.6992
Epoch 68/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5698 - accuracy: 0.6966
Epoch 69/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5804 - accuracy: 0.6914
Epoch 70/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5750 - accuracy: 0.7018
Epoch 71/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5726 - accuracy: 0.6914
Epoch 72/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5674 - accuracy: 0.7096
Epoch 73/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5748 - accuracy: 0.6914
Epoch 74/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5688 - accuracy: 0.6979
Epoch 75/150
77/77 [==============================] - 0s 5ms/step - loss: 0.5744 - accuracy: 0.6953
Epoch 76/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5688 - accuracy: 0.7070
Epoch 77/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5701 - accuracy: 0.7109
Epoch 78/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5705 - accuracy: 0.6979
Epoch 79/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5699 - accuracy: 0.6927
Epoch 80/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5742 - accuracy: 0.7018
Epoch 81/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5663 - accuracy: 0.7044
Epoch 82/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5692 - accuracy: 0.7083
Epoch 83/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5678 - accuracy: 0.7057
Epoch 84/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5740 - accuracy: 0.7005
Epoch 85/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5678 - accuracy: 0.7031
Epoch 86/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5652 - accuracy: 0.6927
Epoch 87/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5666 - accuracy: 0.7096
Epoch 88/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5633 - accuracy: 0.7018
Epoch 89/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5647 - accuracy: 0.7057
Epoch 90/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5642 - accuracy: 0.7031
Epoch 91/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5664 - accuracy: 0.7018
Epoch 92/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5636 - accuracy: 0.6979
Epoch 93/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5691 - accuracy: 0.6992
Epoch 94/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5635 - accuracy: 0.6966
Epoch 95/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5681 - accuracy: 0.6888
Epoch 96/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5661 - accuracy: 0.6966
```

```
Epoch 97/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5630 - accuracy: 0.7083
Epoch 98/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5691 - accuracy: 0.6992
Epoch 99/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5739 - accuracy: 0.6940
Epoch 100/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5651 - accuracy: 0.7096
Epoch 101/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5622 - accuracy: 0.6940
Epoch 102/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5620 - accuracy: 0.7070
Epoch 103/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5677 - accuracy: 0.7057
Epoch 104/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5675 - accuracy: 0.7005
Epoch 105/150
77/77 [==============================] - 0s 5ms/step - loss: 0.5639 - accuracy: 0.7005
Epoch 106/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5635 - accuracy: 0.7005
Epoch 107/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5628 - accuracy: 0.6979
Epoch 108/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5680 - accuracy: 0.7044
Epoch 109/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5613 - accuracy: 0.7109
Epoch 110/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5626 - accuracy: 0.7096
Epoch 111/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5664 - accuracy: 0.7031
Epoch 112/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5625 - accuracy: 0.7031
Epoch 113/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5607 - accuracy: 0.7031
Epoch 114/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5616 - accuracy: 0.7018
Epoch 115/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5624 - accuracy: 0.7083
Epoch 116/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5628 - accuracy: 0.7044
Epoch 117/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5705 - accuracy: 0.7018
Epoch 118/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5568 - accuracy: 0.7083
Epoch 119/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5625 - accuracy: 0.7044
Epoch 120/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5642 - accuracy: 0.7109
Epoch 121/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5655 - accuracy: 0.7044
Epoch 122/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5619 - accuracy: 0.7044
Epoch 123/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5595 - accuracy: 0.7044
Epoch 124/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5573 - accuracy: 0.7083
Epoch 125/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5666 - accuracy: 0.7005
Epoch 126/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5580 - accuracy: 0.7083
Epoch 127/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5579 - accuracy: 0.7018
Epoch 128/150
77/77 [==============================] - 0s 5ms/step - loss: 0.5605 - accuracy: 0.7057
```

```
Epoch 129/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5596 - accuracy: 0.7044
Epoch 130/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5601 - accuracy: 0.6953
Epoch 131/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5582 - accuracy: 0.7083
Epoch 132/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5553 - accuracy: 0.7096
Epoch 133/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5581 - accuracy: 0.6979
Epoch 134/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5571 - accuracy: 0.7070
Epoch 135/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5527 - accuracy: 0.7005
Epoch 136/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5598 - accuracy: 0.7070
Epoch 137/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5571 - accuracy: 0.7109
Epoch 138/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5549 - accuracy: 0.7135
Epoch 139/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5546 - accuracy: 0.7148
Epoch 140/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5534 - accuracy: 0.7096
Epoch 141/150
77/77 [==============================] - 0s 4ms/step - loss: 0.5533 - accuracy: 0.7070
Epoch 142/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5559 - accuracy: 0.7018
Epoch 143/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5698 - accuracy: 0.7109
Epoch 144/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5617 - accuracy: 0.6966
Epoch 145/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5552 - accuracy: 0.7031
Epoch 146/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5553 - accuracy: 0.7031
Epoch 147/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5511 - accuracy: 0.7096
Epoch 148/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5608 - accuracy: 0.7018
Epoch 149/150
77/77 [==============================] - 0s 5ms/step - loss: 0.5523 - accuracy: 0.7096
Epoch 150/150
77/77 [==============================] - 0s 3ms/step - loss: 0.5585 - accuracy: 0.7031
```

Out[ ]:
```
<keras.callbacks.History at 0x2a1a98a8580>
```

Evaluate The Keras Model

In [ ]:
```
_,accuracy = model.evaluate(X,y)

print('Accuracy: %2f'%(accuracy*100))
```

```
24/24 [==============================] - 1s 3ms/step - loss: 0.5521 - accuracy: 0.7122
Accuracy: 71.223956
```

In [ ]:
```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 12)                108

 dense_1 (Dense)             (None, 8)                 104

 dense_2 (Dense)             (None, 1)                 9

=================================================================
Total params: 221
Trainable params: 221
Non-trainable params: 0
_________________________________________________________________
```