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DL_asm1: Q8_2

Student Performance

In [1]:
```
# !pip install ucimlrepo
# !pip install summarytools
```

```
Collecting ucimlrepo
  Downloading ucimlrepo-0.0.7-py3-none-any.whl.metadata (5.5 kB)
Requirement already satisfied: pandas>=1.0.0 in /usr/local/lib/python3.10/dist-packages (from ucimlrepo) (2.2.2)
Requirement already satisfied: certifi>=2020.12.5 in /usr/local/lib/python3.10/dist-packages (from ucimlrepo) (2024.8.30)
Requirement already satisfied: numpy>=1.22.4 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.0.0->ucimlrepo) (1.26.4)
Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.0.0->ucimlrepo) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.0.0->ucimlrepo) (2024.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.0.0->ucimlrepo) (2024.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.8.2->pandas>=1.0.0->ucimlrepo) (1.16.0)
Downloading ucimlrepo-0.0.7-py3-none-any.whl (8.0 kB)
Installing collected packages: ucimlrepo
Successfully installed ucimlrepo-0.0.7
Collecting summarytools
  Downloading summarytools-0.3.0-py3-none-any.whl.metadata (3.5 kB)
Requirement already satisfied: pandas>=1.4.0 in /usr/local/lib/python3.10/dist-packages (from summarytools) (2.2.2)
Requirement already satisfied: ipython>=7.20.0 in /usr/local/lib/python3.10/dist-packages (from summarytools) (7.34.0)
Requirement already satisfied: numpy>=1.18.5 in /usr/local/lib/python3.10/dist-packages (from summarytools) (1.26.4)
Requirement already satisfied: matplotlib>=3.3.0 in /usr/local/lib/python3.10/dist-packages (from summarytools) (3.7.1)
Requirement already satisfied: setuptools>=18.5 in /usr/local/lib/python3.10/dist-packages (from ipython>=7.20.0->summarytools) (71.0.4)
Collecting jedi>=0.16 (from ipython>=7.20.0->summarytools)
  Using cached jedi-0.19.1-py2.py3-none-any.whl.metadata (22 kB)
Requirement already satisfied: decorator in /usr/local/lib/python3.10/dist-packages (from ipython>=7.20.0->summarytools) (4.4.2)
Requirement already satisfied: pickleshare in /usr/local/lib/python3.10/dist-packages (from ipython>=7.20.0->summarytools) (0.7.5)
Requirement already satisfied: traitlets>=4.2 in /usr/local/lib/python3.10/dist-packages (from ipython>=7.20.0->summarytools) (5.7.1)
Requirement already satisfied: prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from ipython>=7.20.0->summaryt
ools) (3.0.48)
Requirement already satisfied: pygments in /usr/local/lib/python3.10/dist-packages (from ipython>=7.20.0->summarytools) (2.18.0)
Requirement already satisfied: backcall in /usr/local/lib/python3.10/dist-packages (from ipython>=7.20.0->summarytools) (0.2.0)
Requirement already satisfied: matplotlib-inline in /usr/local/lib/python3.10/dist-packages (from ipython>=7.20.0->summarytools) (0.1.7)
Requirement already satisfied: pexpect>4.3 in /usr/local/lib/python3.10/dist-packages (from ipython>=7.20.0->summarytools) (4.9.0)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->summarytools) (1.3.0)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->summarytools) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->summarytools) (4.54.1)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->summarytools) (1.4.7)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->summarytools) (24.1)
Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->summarytools) (10.4.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->summarytools) (3.1.4)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->summarytools) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.4.0->summarytools) (2024.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.4.0->summarytools) (2024.2)
Requirement already satisfied: parso<0.9.0,>=0.8.3 in /usr/local/lib/python3.10/dist-packages (from jedi>=0.16->ipython>=7.20.0->summarytools) (0.8.4)
Requirement already satisfied: ptyprocess>=0.5 in /usr/local/lib/python3.10/dist-packages (from pexpect>4.3->ipython>=7.20.0->summarytools) (0.7.0)
Requirement already satisfied: wcwidth in /usr/local/lib/python3.10/dist-packages (from prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0->ipython>=7.20.0-
>summarytools) (0.2.13)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7->matplotlib>=3.3.0->summarytools) (1.16.
0)
Downloading summarytools-0.3.0-py3-none-any.whl (12 kB)
Using cached jedi-0.19.1-py2.py3-none-any.whl (1.6 MB)
Installing collected packages: jedi, summarytools
Successfully installed jedi-0.19.1 summarytools-0.3.0
```

In [2]:
```
from ucimlrepo import fetch_ucirepo
import seaborn as sns
import matplotlib.pyplot as plt
import pandas as pd
from keras.layers import Input
from keras.models import Model
from summarytools import dfSummary as pc
from sklearn.preprocessing import MinMaxScaler
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error, mean_absolute_error, r2_score
import tensorflow as tf
from tensorflow.keras.callbacks import EarlyStopping
```

In [3]:
```
from ucimlrepo import fetch_ucirepo
from summarytools import dfSummary

# fetch dataset
student_performance = fetch_ucirepo(id=320)
```

In [4]:
```
# data (as pandas dataframes)
X = student_performance.data.features
y = student_performance.data.targets
```

In [5]:
```
# variable information
print(student_performance.variables)
```

	name	role	type	demographic	description	units	missing_values
0	school	Feature	Categorical	None	student's school (binary: 'GP' - Gabriel Perei...	None	no
1	sex	Feature	Binary	Sex	student's sex (binary: 'F' - female or 'M' - m...	None	no
2	age	Feature	Integer	Age	student's age (numeric: from 15 to 22)	None	no
3	address	Feature	Categorical	None	student's home address type (binary: 'U' - urb...	None	no
4	famsize	Feature	Categorical	Other	family size (binary: 'LE3' - less or equal to ...	None	no
5	Pstatus	Feature	Categorical	Other	parent's cohabitation status (binary: 'T' - li...	None	no
6	Medu	Feature	Integer	Education Level	mother's education (numeric: 0 - none, 1 - pr...	None	no
7	Fedu	Feature	Integer	Education Level	father's education (numeric: 0 - none, 1 - pr...	None	no
8	Mjob	Feature	Categorical	Occupation	mother's job (nominal: 'teacher', 'health' car...	None	no
9	Fjob	Feature	Categorical	Occupation	father's job (nominal: 'teacher', 'health' car...	None	no
10	reason	Feature	Categorical	None	reason to choose this school (nominal: close t...	None	no
11	guardian	Feature	Categorical	None	student's guardian (nominal: 'mother', 'father...	None	no
12	traveltime	Feature	Integer	None	home to school travel time (numeric: 1 - <15 m...	None	no
13	studytime	Feature	Integer	None	weekly study time (numeric: 1 - <2 hours, 2 - ...	None	no
14	failures	Feature	Integer	None	number of past class failures (numeric: n if 1...	None	no
15	schoolsup	Feature	Binary	None	extra educational support (binary: yes or no)	None	no
16	famsup	Feature	Binary	None			
17	paid	Feature	Binary	None			
18	activities	Feature	Binary	None			
19	nursery	Feature	Binary	None			
20	higher	Feature	Binary	None			
21	internet	Feature	Binary	None			
22	romantic	Feature	Binary	None			
23	famrel	Feature	Integer	None			
24	freetime	Feature	Integer	None			
25	goout	Feature	Integer	None			
26	Dalc	Feature	Integer	None			
27	Walc	Feature	Integer	None			
28	health	Feature	Integer	None			
29	absences	Feature	Integer	None			
30	G1	Target	Categorical	None			
31	G2	Target	Categorical	None			
32	G3	Target	Integer	None			

```
16    family educational support (binary: yes or no)  None           no
17  extra paid classes within the course subject (...  None           no
18   extra-curricular activities (binary: yes or no)  None           no
19       attended nursery school (binary: yes or no)  None           no
20  wants to take higher education (binary: yes or...  None           no
21       Internet access at home (binary: yes or no)  None           no
22  with a romantic relationship (binary: yes or no)  None           no
23  quality of family relationships (numeric: from...  None           no
24  free time after school (numeric: from 1 - very...  None           no
25  going out with friends (numeric: from 1 - very...  None           no
26  workday alcohol consumption (numeric: from 1 -...  None           no
27  weekend alcohol consumption (numeric: from 1 -...  None           no
28  current health status (numeric: from 1 - very ...  None           no
29  number of school absences (numeric: from 0 to 93)  None           no
30        first period grade (numeric: from 0 to 20)  None           no
31       second period grade (numeric: from 0 to 20)  None           no
32  final grade (numeric: from 0 to 20, output tar...  None           no
```

In [6]:
```
dfSummary(X)
```

Out[6]:

Data Frame Summary

X

Dimensions: 649 x 30

Duplicates: 0

No	Variable	Stats / Values	Freqs / (% of Valid)	Graph	Missing
1	**school** [object]	1. GP 2. MS	423 (65.2%) 226 (34.8%)		0 (0.0%)
2	**sex** [object]	1. F 2. M	383 (59.0%) 266 (41.0%)		0 (0.0%)
	age	1. 17 2. 16 3. 18 4. 15	179 (27.6%) 177 (27.3%) 140 (21.6%) 112 (17.3%)		0

In [7]:
```
dfSummary(y)
```

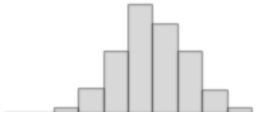
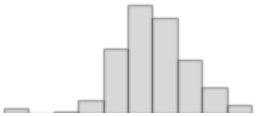
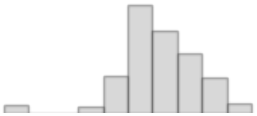
Out[7]:

Data Frame Summary

y

Dimensions: 649 x 3

Duplicates: 456

No	Variable	Stats / Values	Freqs / (% of Valid)	Graph	Missing
1	**G1** [int64]	Mean (sd) : 11.4 (2.7) min < med < max: 0.0 < 11.0 < 19.0 IQR (CV) : 3.0 (4.2)	17 distinct values		0 (0.0%)
2	**G2** [int64]	Mean (sd) : 11.6 (2.9) min < med < max: 0.0 < 11.0 < 19.0 IQR (CV) : 3.0 (4.0)	16 distinct values		0 (0.0%)
3	**G3** [int64]	Mean (sd) : 11.9 (3.2) min < med < max: 0.0 < 12.0 < 19.0 IQR (CV) : 4.0 (3.7)	17 distinct values		0 (0.0%)

In [8]:
```
y.head(15)
```

Out[8]:

	G1	G2	G3
0	0	11	11
1	9	11	11
2	12	13	12
3	14	14	14
4	11	13	13
5	12	12	13
6	13	12	13
7	10	13	13
8	15	16	17
9	12	12	13
10	14	14	14
11	10	12	13
12	12	13	12
13	12	12	13
14	14	14	15

In [9]:
```
y['G1']=y['G1'].astype(int)
y['G2']=y['G2'].astype(int)
y['G3']=y['G3'].astype(int)
```

```
<ipython-input-9-bd385dda4f30>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  y['G1']=y['G1'].astype(int)
<ipython-input-9-bd385dda4f30>:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  y['G2']=y['G2'].astype(int)
<ipython-input-9-bd385dda4f30>:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  y['G3']=y['G3'].astype(int)
```

In [10]:
```
pc(y)
```

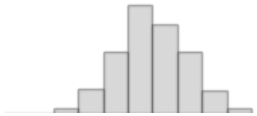
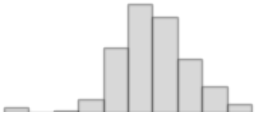
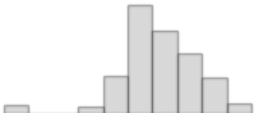
Out[10]:

Data Frame Summary

y

Dimensions: 649 x 3

Duplicates: 456

No	Variable	Stats / Values	Freqs / (% of Valid)	Graph	Missing
1	**G1** [int64]	Mean (sd) : 11.4 (2.7) min < med < max: 0.0 < 11.0 < 19.0 IQR (CV) : 3.0 (4.2)	17 distinct values		0 (0.0%)
2	**G2** [int64]	Mean (sd) : 11.6 (2.9) min < med < max: 0.0 < 11.0 < 19.0 IQR (CV) : 3.0 (4.0)	16 distinct values		0 (0.0%)
3	**G3** [int64]	Mean (sd) : 11.9 (3.2) min < med < max: 0.0 < 12.0 < 19.0 IQR (CV) : 4.0 (3.7)	17 distinct values		0 (0.0%)

In [11]:
```
y['Placed']=y['G3'].apply(lambda x: 1 if x>=11.9 else 0)
```

```
<ipython-input-11-4fbf29e1c8e7>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  y['Placed']=y['G3'].apply(lambda x: 1 if x>=11.9 else 0)
```

In [12]:
```
y.head(10)
```

Out[12]:

	G1	G2	G3	Placed
0	0	11	11	0
1	9	11	11	0
2	12	13	12	1
3	14	14	14	1
4	11	13	13	1
5	12	12	13	1
6	13	12	13	1
7	10	13	13	1
8	15	16	17	1
9	12	12	13	1

In [13]:
```
X['G1'] = y['G1']
X['G2'] = y['G2']
X['G3'] = y['G3']
```

```
<ipython-input-13-e7576f881178>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  X['G1'] = y['G1']
<ipython-input-13-e7576f881178>:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  X['G2'] = y['G2']
```

In [14]:
```
y=y.drop(columns=['G1','G2','G3'])
```

In [15]:
```
y.head(5)
```

Out[15]:

	Placed
0	0
1	0
2	1
3	1
4	1

In [16]:
```
y.value_counts()
```

Out[16]:

Placed	count
1	348
0	301

dtype: int64

In [17]:
```
X.head(5)
```

Out[17]:

	school	sex	age	address	famsize	Pstatus	Medu	Fedu	Mjob	Fjob	...	famrel	freetime	goout	Dalc	Walc	health	absences	G1	G2	G3
0	GP	F	18	U	GT3	A	4	4	at_home	teacher	...	4	3	4	1	1	3	4	0	11	11
1	GP	F	17	U	GT3	T	1	1	at_home	other	...	5	3	3	1	1	3	2	9	11	11
2	GP	F	15	U	LE3	T	1	1	at_home	other	...	4	3	2	2	3	3	6	12	13	12
3	GP	F	15	U	GT3	T	4	2	health	services	...	3	2	2	1	1	5	0	14	14	14
4	GP	F	16	U	GT3	T	3	3	other	other	...	4	3	2	1	2	5	0	11	13	13

5 rows × 33 columns

In [18]:
```
import pandas as pd
from sklearn.preprocessing import LabelEncoder, OneHotEncoder


# Label Encoding for Gender
label_encoder = LabelEncoder()
X['sex'] = label_encoder.fit_transform(X['sex'])
X['school'] = label_encoder.fit_transform(X['school'])
X['address'] = label_encoder.fit_transform(X['address'])
X['Mjob'] = label_encoder.fit_transform(X['Mjob'])
X['Fjob'] = label_encoder.fit_transform(X['Fjob'])
X['reason'] = label_encoder.fit_transform(X['reason'])

# One-Hot Encoding for Ethnicity and Age
# X = pd.get_dummies(X, columns=['Ethnicity'], prefix='Ethnicity')
X = pd.get_dummies(X, columns=['Mjob'], prefix='Mjob')
X = pd.get_dummies(X, columns=['Fjob'], prefix='Fjob')
X = pd.get_dummies(X, columns=['guardian'], prefix='guardian')
# Convert object type columns to numerical using one-hot encoding
X = pd.get_dummies(X, drop_first=True)
```

In [19]:
```
X
```

Out[19]:

	school	sex	age	address	Medu	Fedu	reason	traveltime	studytime	failures	...	famsize_LE3	Pstatus_T	schoolsup_yes	famsup_yes	paid_yes	activities_yes	nursery_yes	higher
0	0	0	18	1	4	4	0	2	2	0	...	False	False	True	False	False	False	True	
1	0	0	17	1	1	1	0	1	2	0	...	False	True	False	True	False	False	False	
2	0	0	15	1	1	1	2	1	2	0	...	True	True	True	False	False	False	True	
3	0	0	15	1	4	2	1	1	3	0	...	False	True	False	True	False	True	True	
4	0	0	16	1	3	3	1	1	2	0	...	False	True	False	True	False	False	True	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
644	1	0	19	0	2	3	0	1	3	1	...	False	True	False	False	False	True	False	
645	1	0	18	1	3	1	0	1	2	0	...	True	True	False	True	False	False	True	
646	1	0	18	1	1	1	0	2	2	0	...	False	True	False	False	False	True	True	
647	1	1	17	1	3	1	0	2	1	0	...	True	True	False	False	False	False	False	
648	1	1	18	0	3	2	0	3	1	0	...	True	True	False	False	False	False	False	

649 rows × 43 columns

In [20]:
```
X.describe()
```

Out[20]:

	school	sex	age	address	Medu	Fedu	reason	traveltime	studytime	failures	famrel	freetime	goout	Dalc	Walc
count	649.000000	649.000000	649.000000	649.000000	649.000000	649.000000	649.000000	649.000000	649.000000	649.000000	649.000000	649.000000	649.000000	649.000000	649.000000
mean	0.348228	0.409861	16.744222	0.696456	2.514638	2.306626	1.112481	1.568567	1.930663	0.221880	3.930663	3.180277	3.184900	1.502311	2.280431
std	0.476776	0.492187	1.218138	0.460143	1.134552	1.099931	1.192045	0.748660	0.829510	0.593235	0.955717	1.051093	1.175766	0.924834	1.284380
min	0.000000	0.000000	15.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.000000	0.000000	1.000000	1.000000	1.000000	1.000000	1.000000
25%	0.000000	0.000000	16.000000	0.000000	2.000000	1.000000	0.000000	1.000000	1.000000	0.000000	4.000000	3.000000	2.000000	1.000000	1.000000
50%	0.000000	0.000000	17.000000	1.000000	2.000000	2.000000	1.000000	1.000000	2.000000	0.000000	4.000000	3.000000	3.000000	1.000000	2.000000
75%	1.000000	1.000000	18.000000	1.000000	4.000000	3.000000	2.000000	2.000000	2.000000	0.000000	5.000000	4.000000	4.000000	2.000000	3.000000
max	1.000000	1.000000	22.000000	1.000000	4.000000	4.000000	3.000000	4.000000	4.000000	3.000000	5.000000	5.000000	5.000000	5.000000	5.000000

In [21]:
```
print(X.dtypes)
```

```
school             int64
sex                int64
age                int64
address            int64
Medu               int64
Fedu               int64
reason             int64
traveltime         int64
studytime          int64
failures           int64
famrel             int64
freetime           int64
goout              int64
Dalc               int64
Walc               int64
health             int64
absences           int64
G1                 int64
G2                 int64
G3                 int64
Mjob_0              bool
Mjob_1              bool
Mjob_2              bool
Mjob_3              bool
Mjob_4              bool
Fjob_0              bool
Fjob_1              bool
Fjob_2              bool
Fjob_3              bool
Fjob_4              bool
guardian_father     bool
guardian_mother     bool
guardian_other      bool
famsize_LE3         bool
Pstatus_T           bool
schoolsup_yes       bool
famsup_yes          bool
paid_yes            bool
activities_yes      bool
nursery_yes         bool
higher_yes          bool
internet_yes        bool
romantic_yes        bool
dtype: object
```

In [22]:
```
from sklearn.preprocessing import MinMaxScaler

# Assuming X is your encoded data
scaler = MinMaxScaler()

# Fit and transform the data to scale it
X = scaler.fit_transform(X)
```

In [23]:
```
print(X[1])
```

```
[0.         0.         0.28571429 1.         0.25       0.25
 0.         0.         0.33333333 0.         1.         0.5
 0.5        0.         0.         0.5        0.0625     0.47368421
 0.57894737 0.57894737 1.         0.         0.         0.
 0.         0.         0.         1.         0.         0.
 1.         0.         0.         0.         1.         0.
 1.         0.         0.         0.         1.         1.
 0.        ]
```

In [24]:
```
X.shape
```

Out[24]:
```
(649, 43)
```

In [32]:
```
# Split dataset
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

Hyperparameter

In [33]:
```
!pip install keras-tuner
```

```
Requirement already satisfied: keras-tuner in /usr/local/lib/python3.10/dist-packages (1.4.7)
Requirement already satisfied: keras in /usr/local/lib/python3.10/dist-packages (from keras-tuner) (3.4.1)
Requirement already satisfied: packaging in /usr/local/lib/python3.10/dist-packages (from keras-tuner) (24.1)
Requirement already satisfied: requests in /usr/local/lib/python3.10/dist-packages (from keras-tuner) (2.32.3)
Requirement already satisfied: kt-legacy in /usr/local/lib/python3.10/dist-packages (from keras-tuner) (1.0.5)
Requirement already satisfied: absl-py in /usr/local/lib/python3.10/dist-packages (from keras->keras-tuner) (1.4.0)
Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-packages (from keras->keras-tuner) (1.26.4)
Requirement already satisfied: rich in /usr/local/lib/python3.10/dist-packages (from keras->keras-tuner) (13.8.1)
Requirement already satisfied: namex in /usr/local/lib/python3.10/dist-packages (from keras->keras-tuner) (0.0.8)
Requirement already satisfied: h5py in /usr/local/lib/python3.10/dist-packages (from keras->keras-tuner) (3.11.0)
Requirement already satisfied: optree in /usr/local/lib/python3.10/dist-packages (from keras->keras-tuner) (0.12.1)
Requirement already satisfied: ml-dtypes in /usr/local/lib/python3.10/dist-packages (from keras->keras-tuner) (0.4.1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests->keras-tuner) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests->keras-tuner) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests->keras-tuner) (2.2.3)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests->keras-tuner) (2024.8.30)
Requirement already satisfied: typing-extensions>=4.5.0 in /usr/local/lib/python3.10/dist-packages (from optree->keras->keras-tuner) (4.12.2)
Requirement already satisfied: markdown-it-py>=2.2.0 in /usr/local/lib/python3.10/dist-packages (from rich->keras->keras-tuner) (3.0.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in /usr/local/lib/python3.10/dist-packages (from rich->keras->keras-tuner) (2.18.0)
Requirement already satisfied: mdurl~=0.1 in /usr/local/lib/python3.10/dist-packages (from markdown-it-py>=2.2.0->rich->keras->keras-tuner) (0.1.2)
```

In [34]:
```
from itertools import count
from keras.layers import Dense, Dropout
import pandas as pd
import numpy as np
import kerastuner as kt
from keras.models import Sequential
```

In [35]:
```
from itertools import count
from keras.layers import Dense, Dropout

def build_model(hp):

  model = Sequential()

  counter = 0

  for i in range(hp.Int('num_layers', min_value=1, max_value=10)):
    if counter == 0:
      model.add(
          Dense(
              hp.Int('units' + str(i), min_value=8, max_value=512, step=16),
              activation=hp.Choice('activation' + str(i), values=['relu', 'tanh', 'sigmoid']),
              input_dim=43))
      model.add(Dropout(hp.Choice('dropout' + str(i), values=[0.0, 0.1, 0.2, 0.3, 0.4, 0.5])))
    else:
      model.add(
          Dense(
              hp.Int('units' + str(i), min_value=8, max_value=512, step=16),
              activation=hp.Choice('activation' + str(i), values=['relu', 'tanh', 'sigmoid']))
          )
      model.add(Dropout(hp.Choice('dropout' + str(i), values=[0.0, 0.1, 0.2, 0.3, 0.4, 0.5])))

    counter += 1
  model.add(Dense(1, activation='sigmoid'))
  model.compile(
        optimizer=hp.Choice('optimizer', values=['rmsprop', 'adam','SGD']),
        loss='binary_crossentropy',
        metrics=['accuracy']
    )
  return model
```

In [36]:
```
tunner = kt.RandomSearch(build_model,objective='val_accuracy',max_trials=10,
                         directory = 'mydir',
                         project_name = 'All_in_one14')
```

In [37]:
```
tunner.search(X_train,y_train,epochs=50,validation_data=(X_test,y_test))
```

```
Trial 10 Complete [00h 00m 21s]
val_accuracy: 0.9461538195610046

Best val_accuracy So Far: 0.9538461565971375
Total elapsed time: 00h 03m 18s
```

In [38]:
```
tunner.get_best_hyperparameters()[0].values
```

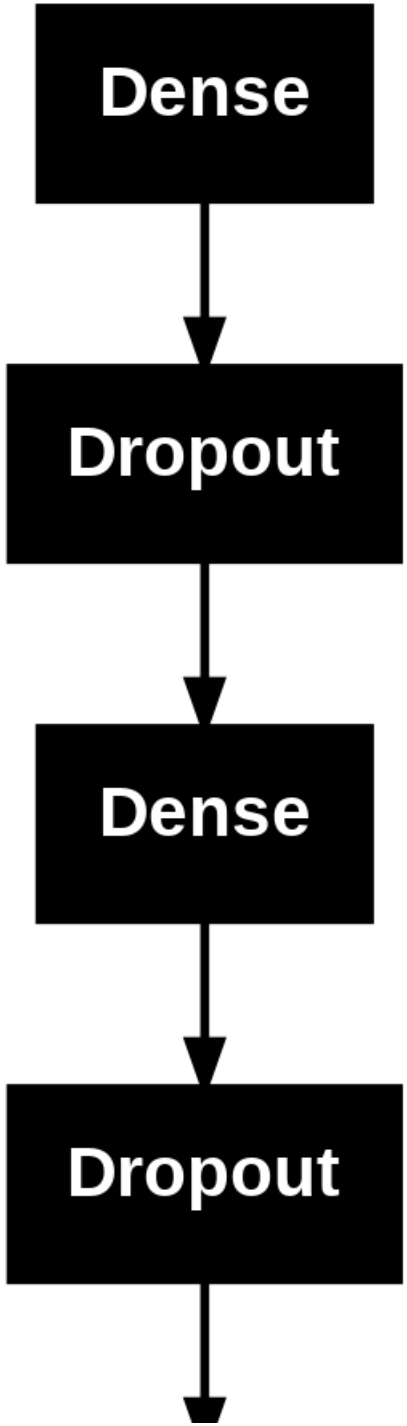
Out[38]:
```
{'num_layers': 3,
 'units0': 408,
 'activation0': 'tanh',
 'dropout0': 0.2,
 'optimizer': 'rmsprop',
 'units1': 200,
 'activation1': 'sigmoid',
 'dropout1': 0.4,
 'units2': 328,
 'activation2': 'tanh',
 'dropout2': 0.4,
 'units3': 296,
 'activation3': 'tanh',
 'dropout3': 0.0,
 'units4': 8,
 'activation4': 'relu',
 'dropout4': 0.2}
```

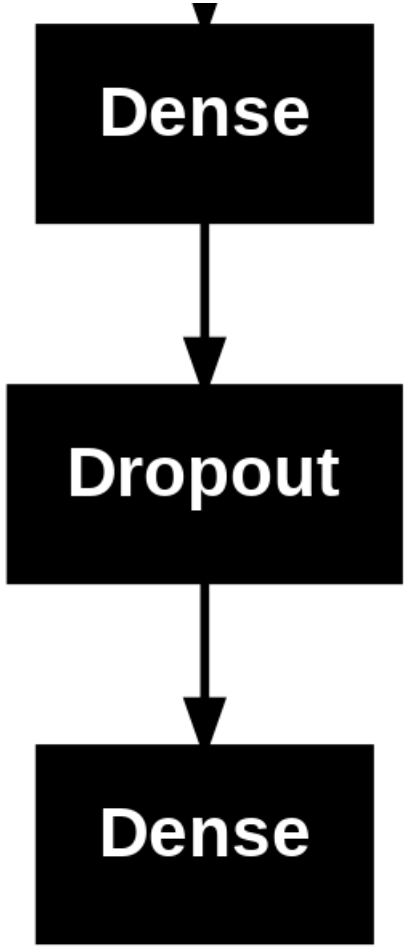
In [116]:
```
# Take best model
model = tunner.get_best_models(num_models=1)[0]
```

```
/usr/local/lib/python3.10/dist-packages/keras/src/layers/core/dense.py:87: UserWarning: Do not pass an `input_shape`/`input_dim` argument to a layer. When using Sequential models, prefer using an `Input(shape)` object as the first layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
/usr/local/lib/python3.10/dist-packages/keras/src/saving/saving_lib.py:576: UserWarning: Skipping variable loading for optimizer 'rmsprop', because it has 2 variables whereas the saved optimizer has 10 variables.
  saveable.load_own_variables(weights_store.get(inner_path))
```

In [117]:
```
from keras.utils import plot_model
plot_model(model,show_shapes=False)
```

Out[117]:


Dense
Dropout
Dense
Dropout


Dense
Dropout
Dense

In [118]:
```
from tensorflow.keras.callbacks import EarlyStopping

early_stopping = EarlyStopping(
    monitor='val_loss',
    patience=50,  # No. of epochs with no improvement after which training will be stopped
    restore_best_weights=True  # Restores model weights from the epoch with the best validation loss
)

from tensorflow.keras.callbacks import ReduceLROnPlateau

reduce_lr = ReduceLROnPlateau(
    monitor='val_loss',
    factor=0.1,  # Reduce learning rate by a factor of 0.1
    patience=5,  # Number of epochs with no improvement before reducing the learning rate
    min_lr=0.0000001  # The minimum learning rate to reduce to
)
```

In [119]:
```
# Traing the model
history = model.fit(X_train,y_train,batch_size=128,epochs=500,verbose=1,validation_data=(X_test,y_test),callbacks=[early_stopping, reduce_lr])
```

```
Epoch 1/500
5/5 ━━━━━━━━━━━━━━━━━━━━ 5s 547ms/step - accuracy: 0.8377 - loss: 0.4725 - val_accuracy: 0.9231 - val_loss: 0.1820 - learning_rate: 0.0010
Epoch 2/500
5/5 ━━━━━━━━━━━━━━━━━━━━ 1s 8ms/step - accuracy: 0.9331 - loss: 0.1573 - val_accuracy: 0.8462 - val_loss: 0.3190 - learning_rate: 0.0010
Epoch 3/500
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.8743 - loss: 0.3163 - val_accuracy: 0.8077 - val_loss: 0.3540 - learning_rate: 0.0010
Epoch 4/500
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.9232 - loss: 0.1913 - val_accuracy: 0.8692 - val_loss: 0.2607 - learning_rate: 0.0010
Epoch 5/500
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.8771 - loss: 0.2849 - val_accuracy: 0.9615 - val_loss: 0.1548 - learning_rate: 0.0010
Epoch 6/500
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.9358 - loss: 0.1650 - val_accuracy: 0.7769 - val_loss: 0.6125 - learning_rate: 0.0010
Epoch 7/500
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.8657 - loss: 0.3054 - val_accuracy: 0.9385 - val_loss: 0.1550 - learning_rate: 0.0010
Epoch 8/500
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.9446 - loss: 0.1512 - val_accuracy: 0.8615 - val_loss: 0.2528 - learning_rate: 0.0010
Epoch 9/500
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.9013 - loss: 0.1967 - val_accuracy: 0.8385 - val_loss: 0.3832 - learning_rate: 0.0010
Epoch 10/500
```

In [120]:
```
model.evaluate(X_test,y_test)
```

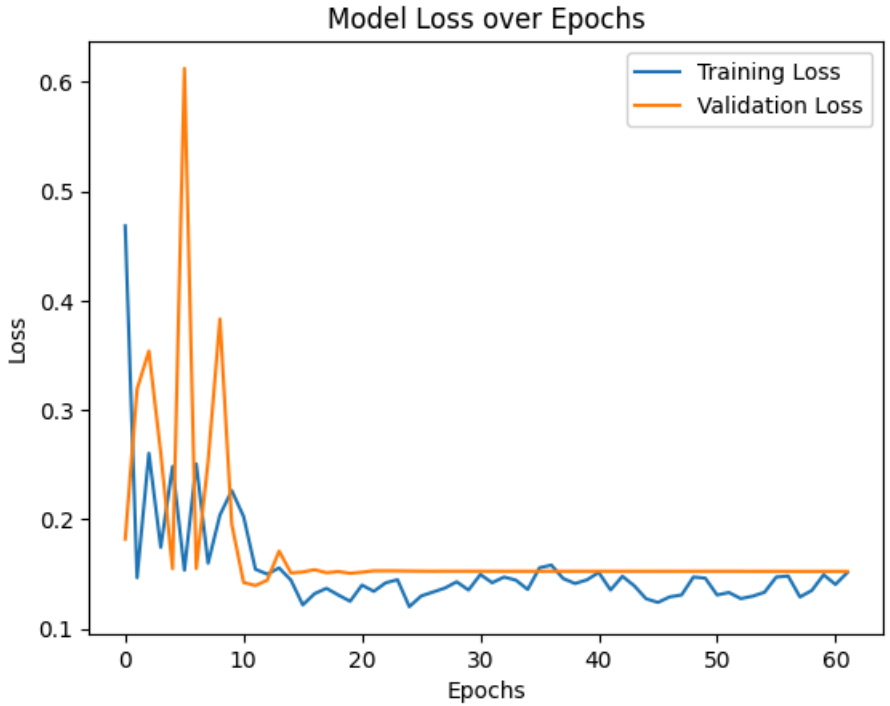
```
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 3ms/step - accuracy: 0.9490 - loss: 0.1428
```

Out[120]:
```
[0.13940347731113434, 0.9538461565971375]
```

In [121]:
```
predictions1=model.predict(X_test)
```

```
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 35ms/step
```

In [122]:
```
import matplotlib.pyplot as plt

# Plotting the loss and val_loss
plt.plot(history.history['loss'], label='Training Loss')
plt.plot(history.history['val_loss'], label='Validation Loss')

# Adding labels and legend
plt.title('Model Loss over Epochs')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend()

# Show plot
plt.show()
```



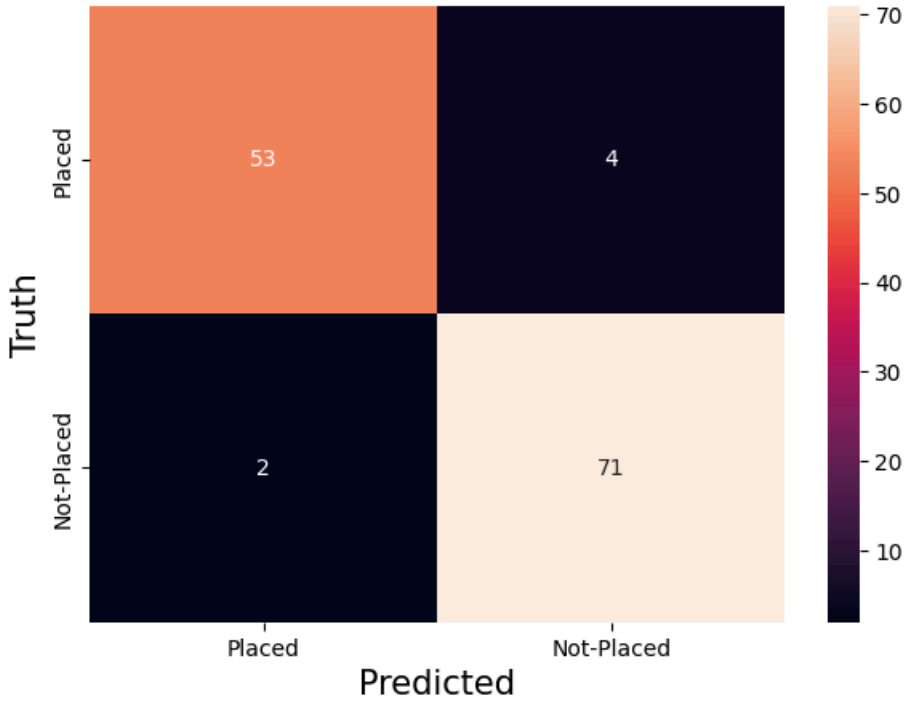
In [127]:
```
#Predicted On The Test Set
y_pred= model.predict(X_test)
```

```
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step
```

In [131]:
```
# Confusion Matrix
from sklearn.metrics import confusion_matrix,classification_report

# Convert predictions to binary values (adjust threshold as needed)
threshold = 0.5  # Example threshold
y_pred_binary = (y_pred > threshold).astype(int)

cm = confusion_matrix(y_test, y_pred_binary)
print(cm)
```

```
[[53  4]
 [ 2 71]]
```

In [132]:
```
# confusion metric visual
import seaborn as sn
plt.figure(figsize=(7,5))
cm_df = pd.DataFrame(cm,
                     index = ['Placed','Not-Placed'],
                     columns = ['Placed','Not-Placed'])
sn.heatmap(cm_df,annot=True)

plt.xlabel('Predicted',color='black',size=15)
plt.ylabel('Truth',color='black',size=15)
plt.show()
```



In [ ]: