Decision Tree Classification

Importing the libraries

In [0]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

Importing the dataset

In [0]:
```
dataset = pd.read_csv('Social_Network_Ads.csv')
X = dataset.iloc[:, :-1].values
y = dataset.iloc[:, -1].values
```

Splitting the dataset into the Training set and Test set

In [0]:
```
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
5, random_state = 0)
```

In [4]:
```
print(X_train)
```

```
[[    44  39000]
 [    32 120000]
 [    38  50000]
 [    32 135000]
 [    52  21000]
 [    53 104000]
 [    39  42000]
 [    38  61000]
 [    36  50000]
 [    36  63000]
 [    35  25000]
 [    35  50000]
 [    42  73000]
 [    47  49000]
 [    59  29000]
 [    49  65000]
 [    45 131000]
 [    31  89000]
 [    46  82000]
 [    47  51000]
 [    26  15000]
 [    60 102000]
 [    38 112000]
 [    40 107000]
 [    42  53000]
 [    35  59000]
 [    48  41000]
 [    48 134000]
 [    38 113000]
 [    29 148000]
 [    26  15000]
 [    60  42000]
 [    24  19000]
 [    42 149000]
 [    46  96000]
 [    28  59000]
 [    39  96000]
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 [    41  72000]
 [    45  26000]
 [    33  69000]
 [    20  82000]
 [    31  74000]
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 [    33 149000]
 [    40  71000]
 [    51 146000]
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 [    20  82000]
 [    57  74000]
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 [    42  65000]
 [    26  80000]
 [    46 117000]
 [    35  61000]
 [    21  68000]
 [    28  44000]
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 [    26  43000]
 [    40  78000]
 [    46  59000]
 [    59  42000]
 [    46  74000]
 [    35  91000]
 [    28  59000]
 [    40  57000]
 [    59 143000]
 [    57  26000]
 [    52  38000]
 [    47 113000]
 [    53 143000]
 [    35  27000]
 [    58 101000]
 [    45  45000]
 [    23  82000]
 [    46  23000]
 [    42  65000]
 [    28  84000]
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 [     29  28000]
 [     37  71000]
 [     22  55000]
 [     48  35000]
 [     49  28000]
 [     38  65000]
 [     27  17000]
 [     46  28000]
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 [     26  17000]
 [     35  97000]
 [     39  59000]
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 [     40  72000]
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 [     50  44000]
 [     35  72000]
 [     40 142000]
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 [     39  71000]
 [     20  74000]
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 [     31  76000]
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 [     34 112000]
 [     38  80000]
 [     42  75000]
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 [     36  60000]
 [     41  52000]
 [     36 125000]
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 [     36 126000]
 [     51 134000]
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 [     39  61000]
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 [     48  74000]
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 [    53  72000]
 [    32 117000]
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 [    45  79000]
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 [    40  75000]
 [    33  28000]
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 [    22  18000]
 [    33  51000]
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 [    39 122000]
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 [    29  83000]
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 [    29  47000]
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 [    42  54000]
 [    30 135000]
 [    52 114000]
 [    50  36000]
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 [    29  61000]
 [    30  89000]
 [    26  16000]
 [    33  31000]
 [    41  72000]
 [    36  33000]
 [    55 125000]
 [    48 131000]
 [    41  71000]
 [    30  62000]
 [    37  72000]
```

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 [     41  63000]
 [     58  47000]
 [     30 116000]
 [     20  49000]
 [     37  74000]
 [     41  59000]
 [     49  89000]
 [     28  79000]
 [     53  82000]
 [     40  57000]
 [     60  34000]
 [     35 108000]
 [     21  72000]
 [     38  71000]
 [     39 106000]
 [     37  57000]
 [     26  72000]
 [     35  23000]
 [     54 108000]
 [     30  17000]
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 [     35  38000]
 [     41  45000]
 [     41  72000]
 [     39 134000]
 [     27 137000]
 [     21  16000]
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 [     31  66000]
 [     39  73000]
 [     41  79000]
 [     47  50000]
 [     41  30000]
 [     37  93000]
 [     60  46000]
 [     25  22000]
 [     28  37000]
 [     38  55000]
 [     36  54000]
 [     20  36000]
 [     56 104000]
 [     40  57000]
 [     42 108000]
 [     20  23000]
 [     40  65000]
 [     47  20000]
 [     18  86000]
 [     35  79000]
 [     57  33000]
 [     34  72000]
 [     49  39000]
 [     27  31000]
 [     19  70000]
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 [     26  81000]
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 [     55  39000]
 [     50  88000]
 [     49  88000]
 [     52 150000]
 [     35  65000]
 [     42  54000]
 [     34  43000]
 [     37  52000]
 [     48  30000]
 [     29  43000]
 [     36  52000]
 [     27  54000]
 [     26 118000]]
```

In [5]:
```
print(y_train)
```

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

In [6]:
```
print(X_test)
```

```
[[     30  87000]
 [     38  50000]
 [     35  75000]
 [     30  79000]
 [     35  50000]
 [     27  20000]
 [     31  15000]
 [     36 144000]
 [     18  68000]
 [     47  43000]
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 [     28  55000]
 [     37  55000]
 [     39  77000]
 [     20  86000]
 [     32 117000]
 [     37  77000]
 [     19  85000]
 [     55 130000]
 [     35  22000]
 [     35  47000]
 [     47 144000]
 [     41  51000]
 [     47 105000]
 [     23  28000]
 [     49 141000]
 [     28  87000]
 [     29  80000]
 [     37  62000]
 [     32  86000]
 [     21  88000]
 [     37  79000]
 [     57  60000]
 [     37  53000]
 [     24  58000]
 [     18  52000]
 [     22  81000]
 [     34  43000]
 [     31  34000]
 [     49  36000]
 [     27  88000]
 [     41  52000]
 [     27  84000]
 [     35  20000]
 [     43 112000]
 [     27  58000]
 [     37  80000]
 [     52  90000]
 [     26  30000]
 [     49  86000]
 [     57 122000]
 [     34  25000]
 [     35  57000]
 [     34 115000]
 [     59  88000]
 [     45  32000]
 [     29  83000]
```

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 [    26  80000]
 [    49  28000]
 [    23  20000]
 [    32  18000]
 [    60  42000]
 [    19  76000]
 [    36  99000]
 [    19  26000]
 [    60  83000]
 [    24  89000]
 [    27  58000]
 [    40  47000]
 [    42  70000]
 [    32 150000]
 [    35  77000]
 [    22  63000]
 [    45  22000]
 [    27  89000]
 [    18  82000]
 [    42  79000]
 [    40  60000]
 [    53  34000]
 [    47 107000]
 [    58 144000]
 [    59  83000]
 [    24  55000]
 [    26  35000]
 [    58  38000]
 [    42  80000]
 [    40  75000]
 [    59 130000]
 [    46  41000]
 [    41  60000]
 [    42  64000]
 [    37 146000]
 [    23  48000]
 [    25  33000]
 [    24  84000]
 [    27  96000]
 [    23  63000]
 [    48  33000]
 [    48  90000]
 [    42 104000]]
```

In [7]:
```
print(y_test)
```

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

Feature Scaling

In [0]:
```
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)
```

In [9]:
```
print(X_train)
```

```
[[ 0.58164944 -0.88670699]
 [-0.60673761  1.46173768]
 [-0.01254409 -0.5677824 ]
 [-0.60673761  1.89663484]
 [ 1.37390747 -1.40858358]
 [ 1.47293972  0.99784738]
 [ 0.08648817 -0.79972756]
 [-0.01254409 -0.24885782]
 [-0.21060859 -0.5677824 ]
 [-0.21060859 -0.19087153]
 [-0.30964085 -1.29261101]
 [-0.30964085 -0.5677824 ]
 [ 0.38358493  0.09905991]
 [ 0.8787462  -0.59677555]
 [ 2.06713324 -1.17663843]
 [ 1.07681071 -0.13288524]
 [ 0.68068169  1.78066227]
 [-0.70576986  0.56295021]
 [ 0.77971394  0.35999821]
 [ 0.8787462  -0.53878926]
 [-1.20093113 -1.58254245]
 [ 2.1661655   0.93986109]
 [-0.01254409  1.22979253]
 [ 0.18552042  1.08482681]
 [ 0.38358493 -0.48080297]
 [-0.30964085 -0.30684411]
 [ 0.97777845 -0.8287207 ]
 [ 0.97777845  1.8676417 ]
 [-0.01254409  1.25878567]
 [-0.90383437  2.27354572]
 [-1.20093113 -1.58254245]
 [ 2.1661655  -0.79972756]
 [-1.39899564 -1.46656987]
 [ 0.38358493  2.30253886]
 [ 0.77971394  0.76590222]
 [-1.00286662 -0.30684411]
 [ 0.08648817  0.76590222]
 [-1.00286662  0.56295021]
 [ 0.28455268  0.07006676]
 [ 0.68068169 -1.26361786]
 [-0.50770535 -0.01691267]
 [-1.79512465  0.35999821]
 [-0.70576986  0.12805305]
 [ 0.38358493  0.30201192]
 [-0.30964085  0.07006676]
 [-0.50770535  2.30253886]
 [ 0.18552042  0.04107362]
 [ 1.27487521  2.21555943]
 [ 0.77971394  0.27301877]
 [-0.30964085  0.1570462 ]
 [-0.01254409 -0.53878926]
 [-0.21060859  0.1570462 ]
 [-0.11157634  0.24402563]
 [-0.01254409 -0.24885782]
 [ 2.1661655   1.11381995]
 [-1.79512465  0.35999821]
 [ 1.86906873  0.12805305]
```

```
 [ 0.38358493 -0.13288524]
 [-1.20093113  0.30201192]
 [ 0.77971394  1.37475825]
 [-0.30964085 -0.24885782]
 [-1.6960924  -0.04590581]
 [-1.00286662 -0.74174127]
 [ 0.28455268  0.50496393]
 [-0.11157634 -1.06066585]
 [-1.10189888  0.59194336]
 [ 0.08648817 -0.79972756]
 [-1.00286662  1.54871711]
 [-0.70576986  1.40375139]
 [-1.29996338  0.50496393]
 [-0.30964085  0.04107362]
 [-0.11157634  0.01208048]
 [-0.30964085 -0.88670699]
 [ 0.8787462  -1.3505973 ]
 [-0.30964085  2.24455257]
 [ 0.97777845  1.98361427]
 [-1.20093113  0.47597078]
 [-1.29996338  0.27301877]
 [ 1.37390747  1.98361427]
 [ 1.27487521 -1.3505973 ]
 [-0.30964085 -0.27785096]
 [-0.50770535  1.25878567]
 [-0.80480212  1.08482681]
 [ 0.97777845 -1.06066585]
 [ 0.28455268  0.30201192]
 [ 0.97777845  0.76590222]
 [-0.70576986 -1.49556302]
 [-0.70576986  0.04107362]
 [ 0.48261718  1.72267598]
 [ 2.06713324  0.18603934]
 [-1.99318916 -0.74174127]
 [-0.21060859  1.40375139]
 [ 0.38358493  0.59194336]
 [ 0.8787462  -1.14764529]
 [-1.20093113 -0.77073441]
 [ 0.18552042  0.24402563]
 [ 0.77971394 -0.30684411]
 [ 2.06713324 -0.79972756]
 [ 0.77971394  0.12805305]
 [-0.30964085  0.6209365 ]
 [-1.00286662 -0.30684411]
 [ 0.18552042 -0.3648304 ]
 [ 2.06713324  2.12857999]
 [ 1.86906873 -1.26361786]
 [ 1.37390747 -0.91570013]
 [ 0.8787462   1.25878567]
 [ 1.47293972  2.12857999]
 [-0.30964085 -1.23462472]
 [ 1.96810099  0.91086794]
 [ 0.68068169 -0.71274813]
 [-1.49802789  0.35999821]
 [ 0.77971394 -1.3505973 ]
 [ 0.38358493 -0.13288524]
 [-1.00286662  0.41798449]
```

```
 [-0.01254409 -0.30684411]
 [-1.20093113  0.41798449]
 [-0.90383437 -1.20563157]
 [-0.11157634  0.04107362]
 [-1.59706014 -0.42281668]
 [ 0.97777845 -1.00267957]
 [ 1.07681071 -1.20563157]
 [-0.01254409 -0.13288524]
 [-1.10189888 -1.52455616]
 [ 0.77971394 -1.20563157]
 [ 0.97777845  2.07059371]
 [-1.20093113 -1.52455616]
 [-0.30964085  0.79489537]
 [ 0.08648817 -0.30684411]
 [-1.39899564 -1.23462472]
 [-0.60673761 -1.49556302]
 [ 0.77971394  0.53395707]
 [-0.30964085 -0.33583725]
 [ 1.77003648 -0.27785096]
 [ 0.8787462  -1.03167271]
 [ 0.18552042  0.07006676]
 [-0.60673761  0.8818748 ]
 [-1.89415691 -1.40858358]
 [-1.29996338  0.59194336]
 [-0.30964085  0.53395707]
 [-1.00286662 -1.089659  ]
 [ 1.17584296 -1.43757673]
 [ 0.18552042 -0.30684411]
 [ 1.17584296 -0.74174127]
 [-0.30964085  0.07006676]
 [ 0.18552042  2.09958685]
 [ 0.77971394 -1.089659  ]
 [ 0.08648817  0.04107362]
 [-1.79512465  0.12805305]
 [-0.90383437  0.1570462 ]
 [-0.70576986  0.18603934]
 [ 0.8787462  -1.29261101]
 [ 0.18552042 -0.24885782]
 [-0.4086731   1.22979253]
 [-0.01254409  0.30201192]
 [ 0.38358493  0.1570462 ]
 [ 0.8787462  -0.65476184]
 [ 0.08648817  0.1570462 ]
 [-1.89415691 -1.29261101]
 [-0.11157634  0.30201192]
 [-0.21060859 -0.27785096]
 [ 0.28455268 -0.50979612]
 [-0.21060859  1.6067034 ]
 [ 0.97777845 -1.17663843]
 [-0.21060859  1.63569655]
 [ 1.27487521  1.8676417 ]
 [-1.10189888 -0.3648304 ]
 [-0.01254409  0.04107362]
 [ 0.08648817 -0.24885782]
 [-1.59706014 -1.23462472]
 [-0.50770535 -0.27785096]
 [ 0.97777845  0.12805305]
```

```
[ 1.96810099 -1.3505973 ]
[ 1.47293972  0.07006676]
[-0.60673761  1.37475825]
[ 1.57197197  0.01208048]
[-0.80480212  0.30201192]
[ 1.96810099  0.73690908]
[-1.20093113 -0.50979612]
[ 0.68068169  0.27301877]
[-1.39899564 -0.42281668]
[ 0.18552042  0.1570462 ]
[-0.50770535 -1.20563157]
[ 0.58164944  2.01260742]
[-1.59706014 -1.49556302]
[-0.50770535 -0.53878926]
[ 0.48261718  1.83864855]
[-1.39899564 -1.089659  ]
[ 0.77971394 -1.37959044]
[-0.30964085 -0.42281668]
[ 1.57197197  0.99784738]
[ 0.97777845  1.43274454]
[-0.30964085 -0.48080297]
[-0.11157634  2.15757314]
[-1.49802789 -0.1038921 ]
[-0.11157634  1.95462113]
[-0.70576986 -0.33583725]
[-0.50770535 -0.8287207 ]
[ 0.68068169 -1.37959044]
[-0.80480212 -1.58254245]
[-1.89415691 -1.46656987]
[ 1.07681071  0.12805305]
[ 0.08648817  1.51972397]
[-0.30964085  0.09905991]
[ 0.08648817  0.04107362]
[-1.39899564 -1.3505973 ]
[ 0.28455268  0.07006676]
[-0.90383437  0.38899135]
[ 1.57197197 -1.26361786]
[-0.30964085 -0.74174127]
[-0.11157634  0.1570462 ]
[-0.90383437 -0.65476184]
[-0.70576986 -0.04590581]
[ 0.38358493 -0.45180983]
[-0.80480212  1.89663484]
[ 1.37390747  1.28777882]
[ 1.17584296 -0.97368642]
[ 1.77003648  1.83864855]
[-0.90383437 -0.24885782]
[-0.80480212  0.56295021]
[-1.20093113 -1.5535493 ]
[-0.50770535 -1.11865214]
[ 0.28455268  0.07006676]
[-0.21060859 -1.06066585]
[ 1.67100423  1.6067034 ]
[ 0.97777845  1.78066227]
[ 0.28455268  0.04107362]
[-0.80480212 -0.21986468]
[-0.11157634  0.07006676]
```

```
 [ 0.28455268 -0.19087153]
 [ 1.96810099 -0.65476184]
 [-0.80480212  1.3457651 ]
 [-1.79512465 -0.59677555]
 [-0.11157634  0.12805305]
 [ 0.28455268 -0.30684411]
 [ 1.07681071  0.56295021]
 [-1.00286662  0.27301877]
 [ 1.47293972  0.35999821]
 [ 0.18552042 -0.3648304 ]
 [ 2.1661655  -1.03167271]
 [-0.30964085  1.11381995]
 [-1.6960924   0.07006676]
 [-0.01254409  0.04107362]
 [ 0.08648817  1.05583366]
 [-0.11157634 -0.3648304 ]
 [-1.20093113  0.07006676]
 [-0.30964085 -1.3505973 ]
 [ 1.57197197  1.11381995]
 [-0.80480212 -1.52455616]
 [ 0.08648817  1.8676417 ]
 [-0.90383437 -0.77073441]
 [-0.50770535 -0.77073441]
 [-0.30964085 -0.91570013]
 [ 0.28455268 -0.71274813]
 [ 0.28455268  0.07006676]
 [ 0.08648817  1.8676417 ]
 [-1.10189888  1.95462113]
 [-1.6960924  -1.5535493 ]
 [-1.20093113 -1.089659  ]
 [-0.70576986 -0.1038921 ]
 [ 0.08648817  0.09905991]
 [ 0.28455268  0.27301877]
 [ 0.8787462  -0.5677824 ]
 [ 0.28455268 -1.14764529]
 [-0.11157634  0.67892279]
 [ 2.1661655  -0.68375498]
 [-1.29996338 -1.37959044]
 [-1.00286662 -0.94469328]
 [-0.01254409 -0.42281668]
 [-0.21060859 -0.45180983]
 [-1.79512465 -0.97368642]
 [ 1.77003648  0.99784738]
 [ 0.18552042 -0.3648304 ]
 [ 0.38358493  1.11381995]
 [-1.79512465 -1.3505973 ]
 [ 0.18552042 -0.13288524]
 [ 0.8787462  -1.43757673]
 [-1.99318916  0.47597078]
 [-0.30964085  0.27301877]
 [ 1.86906873 -1.06066585]
 [-0.4086731   0.07006676]
 [ 1.07681071 -0.88670699]
 [-1.10189888 -1.11865214]
 [-1.89415691  0.01208048]
 [ 0.08648817  0.27301877]
 [-1.20093113  0.33100506]
```

```
 [-1.29996338  0.30201192]
 [-1.00286662  0.44697764]
 [ 1.67100423 -0.88670699]
 [ 1.17584296  0.53395707]
 [ 1.07681071  0.53395707]
 [ 1.37390747  2.331532  ]
 [-0.30964085 -0.13288524]
 [ 0.38358493 -0.45180983]
 [-0.4086731  -0.77073441]
 [-0.11157634 -0.50979612]
 [ 0.97777845 -1.14764529]
 [-0.90383437 -0.77073441]
 [-0.21060859 -0.50979612]
 [-1.10189888 -0.45180983]
 [-1.20093113  1.40375139]]
```

In [10]:
```
print(X_test)
```

```
[[-0.80480212  0.50496393]
 [-0.01254409 -0.5677824 ]
 [-0.30964085  0.1570462 ]
 [-0.80480212  0.27301877]
 [-0.30964085 -0.5677824 ]
 [-1.10189888 -1.43757673]
 [-0.70576986 -1.58254245]
 [-0.21060859  2.15757314]
 [-1.99318916 -0.04590581]
 [ 0.8787462  -0.77073441]
 [-0.80480212 -0.59677555]
 [-1.00286662 -0.42281668]
 [-0.11157634 -0.42281668]
 [ 0.08648817  0.21503249]
 [-1.79512465  0.47597078]
 [-0.60673761  1.37475825]
 [-0.11157634  0.21503249]
 [-1.89415691  0.44697764]
 [ 1.67100423  1.75166912]
 [-0.30964085 -1.37959044]
 [-0.30964085 -0.65476184]
 [ 0.8787462   2.15757314]
 [ 0.28455268 -0.53878926]
 [ 0.8787462   1.02684052]
 [-1.49802789 -1.20563157]
 [ 1.07681071  2.07059371]
 [-1.00286662  0.50496393]
 [-0.90383437  0.30201192]
 [-0.11157634 -0.21986468]
 [-0.60673761  0.47597078]
 [-1.6960924   0.53395707]
 [-0.11157634  0.27301877]
 [ 1.86906873 -0.27785096]
 [-0.11157634 -0.48080297]
 [-1.39899564 -0.33583725]
 [-1.99318916 -0.50979612]
 [-1.59706014  0.33100506]
 [-0.4086731  -0.77073441]
 [-0.70576986 -1.03167271]
 [ 1.07681071 -0.97368642]
 [-1.10189888  0.53395707]
 [ 0.28455268 -0.50979612]
 [-1.10189888  0.41798449]
 [-0.30964085 -1.43757673]
 [ 0.48261718  1.22979253]
 [-1.10189888 -0.33583725]
 [-0.11157634  0.30201192]
 [ 1.37390747  0.59194336]
 [-1.20093113 -1.14764529]
 [ 1.07681071  0.47597078]
 [ 1.86906873  1.51972397]
 [-0.4086731  -1.29261101]
 [-0.30964085 -0.3648304 ]
 [-0.4086731   1.31677196]
 [ 2.06713324  0.53395707]
 [ 0.68068169 -1.089659  ]
 [-0.90383437  0.38899135]
```

```
 [-1.20093113  0.30201192]
 [ 1.07681071 -1.20563157]
 [-1.49802789 -1.43757673]
 [-0.60673761 -1.49556302]
 [ 2.1661655  -0.79972756]
 [-1.89415691  0.18603934]
 [-0.21060859  0.85288166]
 [-1.89415691 -1.26361786]
 [ 2.1661655   0.38899135]
 [-1.39899564  0.56295021]
 [-1.10189888 -0.33583725]
 [ 0.18552042 -0.65476184]
 [ 0.38358493  0.01208048]
 [-0.60673761  2.331532  ]
 [-0.30964085  0.21503249]
 [-1.59706014 -0.19087153]
 [ 0.68068169 -1.37959044]
 [-1.10189888  0.56295021]
 [-1.99318916  0.35999821]
 [ 0.38358493  0.27301877]
 [ 0.18552042 -0.27785096]
 [ 1.47293972 -1.03167271]
 [ 0.8787462   1.08482681]
 [ 1.96810099  2.15757314]
 [ 2.06713324  0.38899135]
 [-1.39899564 -0.42281668]
 [-1.20093113 -1.00267957]
 [ 1.96810099 -0.91570013]
 [ 0.38358493  0.30201192]
 [ 0.18552042  0.1570462 ]
 [ 2.06713324  1.75166912]
 [ 0.77971394 -0.8287207 ]
 [ 0.28455268 -0.27785096]
 [ 0.38358493 -0.16187839]
 [-0.11157634  2.21555943]
 [-1.49802789 -0.62576869]
 [-1.29996338 -1.06066585]
 [-1.39899564  0.41798449]
 [-1.10189888  0.76590222]
 [-1.49802789 -0.19087153]
 [ 0.97777845 -1.06066585]
 [ 0.97777845  0.59194336]
 [ 0.38358493  0.99784738]]
```

Training the Decision Tree Classification model on the Training set

In [11]:
```
from sklearn.tree import DecisionTreeClassifier
classifier = DecisionTreeClassifier(criterion = 'entropy', random_state =
0)
classifier.fit(X_train, y_train)
```

Out[11]:
```
DecisionTreeClassifier(ccp_alpha=0.0, class_weight=None, criterion='ent
ropy',
                       max_depth=None, max_features=None, max_leaf_node
s=None,
                       min_impurity_decrease=0.0, min_impurity_split=No
ne,
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0, presort='deprecate
d',
                       random_state=0, splitter='best')
```

Predicting a new result

In [12]:
```
print(classifier.predict(sc.transform([[30,87000]])))
```

```
[0]
```

Predicting the Test set results

In [13]:
```
y_pred = classifier.predict(X_test)
print(np.concatenate((y_pred.reshape(len(y_pred),1), y_test.reshape(len(y_test),1)),1))
```

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

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

Making the Confusion Matrix

In [14]:
```
from sklearn.metrics import confusion_matrix, accuracy_score
cm = confusion_matrix(y_test, y_pred)
print(cm)
accuracy_score(y_test, y_pred)
```

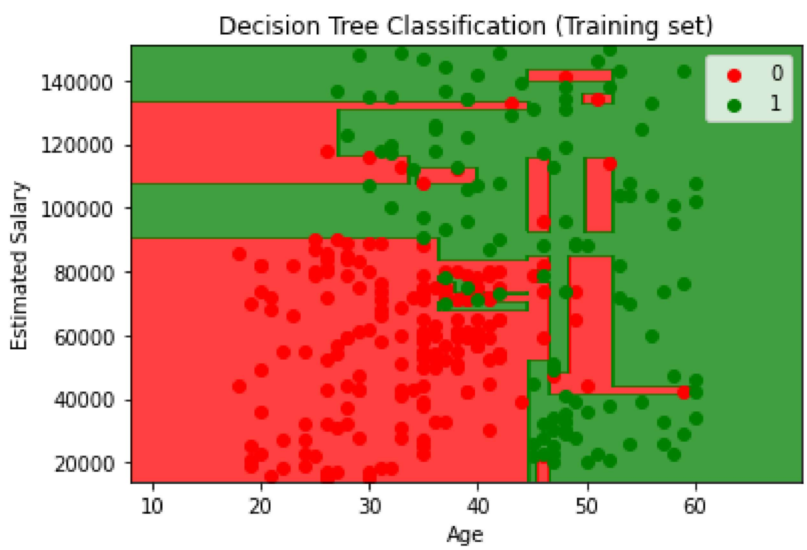
```
[[62  6]
 [ 3 29]]
```

Out[14]:
```
0.91
```

Visualising the Training set results

In [15]:
```
from matplotlib.colors import ListedColormap
X_set, y_set = sc.inverse_transform(X_train), y_train
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 10, stop = X_s
et[:, 0].max() + 10, step = 0.25),
                     np.arange(start = X_set[:, 1].min() - 1000, stop = X
_set[:, 1].max() + 1000, step = 0.25))
plt.contourf(X1, X2, classifier.predict(sc.transform(np.array([X1.ravel
(), X2.ravel()]).T)).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1], c = ListedCol
ormap(('red', 'green'))(i), label = j)
plt.title('Decision Tree Classification (Training set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()
plt.show()
```

```
'c' argument looks like a single numeric RGB or RGBA sequence, which sh
ould be avoided as value-mapping will have precedence in case its lengt
h matches with 'x' & 'y'.  Please use a 2-D array with a single row if
you really want to specify the same RGB or RGBA value for all points.
'c' argument looks like a single numeric RGB or RGBA sequence, which sh
ould be avoided as value-mapping will have precedence in case its lengt
h matches with 'x' & 'y'.  Please use a 2-D array with a single row if
you really want to specify the same RGB or RGBA value for all points.
```



Visualising the Test set results

In [16]:

```
from matplotlib.colors import ListedColormap
X_set, y_set = sc.inverse_transform(X_test), y_test
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 10, stop = X_s
et[:, 0].max() + 10, step = 0.25),
                     np.arange(start = X_set[:, 1].min() - 1000, stop = X
_set[:, 1].max() + 1000, step = 0.25))
plt.contourf(X1, X2, classifier.predict(sc.transform(np.array([X1.ravel
(), X2.ravel()]).T)).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1], c = ListedCol
ormap(('red', 'green'))(i), label = j)
plt.title('Decision Tree Classification (Test set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()
plt.show()
```

```
'c' argument looks like a single numeric RGB or RGBA sequence, which sh
ould be avoided as value-mapping will have precedence in case its lengt
h matches with 'x' & 'y'.  Please use a 2-D array with a single row if
you really want to specify the same RGB or RGBA value for all points.
'c' argument looks like a single numeric RGB or RGBA sequence, which sh
ould be avoided as value-mapping will have precedence in case its lengt
h matches with 'x' & 'y'.  Please use a 2-D array with a single row if
you really want to specify the same RGB or RGBA value for all points.
```