In [74]:
```python
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
from random import randint
from sklearn.metrics import accuracy_score
```

In [37]:
```python
train_df = pd.read_csv("train.csv")
test_df = pd.read_csv("test.csv")
```

In [38]:
```python
train_df.head(3)
```

Out[38]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN	S
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85	C
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN	S

In [39]:
```python
train_df.head()
```

Out[39]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN	S
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85	C
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN	S
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	C123	S
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	NaN	S

In [40]:
```python
train_df.shape
```

Out[40]:
```
(891, 12)
```

In [41]:
```python
X = train_df.drop(columns=["Survived", "Name", "Sex", "Ticket", "Cabin", "Embarked"])
```

In [42]:
```python
X.head()
```

Out[42]:

	PassengerId	Pclass	Age	SibSp	Parch	Fare
0	1	3	22.0	1	0	7.2500
1	2	1	38.0	1	0	71.2833
2	3	3	26.0	0	0	7.9250
3	4	1	35.0	1	0	53.1000
4	5	3	35.0	0	0	8.0500

In [58]:
```python
X.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 6 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   PassengerId  891 non-null    int64  
 1   Pclass       891 non-null    int64  
 2   Age          714 non-null    float64
 3   SibSp        891 non-null    int64  
 4   Parch        891 non-null    int64  
 5   Fare         891 non-null    float64
dtypes: float64(2), int64(4)
memory usage: 41.9 KB
```

In [43]:
```python
y = train_df['Survived']
```

In [44]:
```python
y.head()
```

Out[44]:
```
0    0
1    1
2    1
3    1
4    0
Name: Survived, dtype: int64
```

In [45]:
```python
train_df.describe()
```

Out[45]:

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
count	891.000000	891.000000	891.000000	714.000000	891.000000	891.000000	891.000000
mean	446.000000	0.383838	2.308642	29.699118	0.523008	0.381594	32.204208
std	257.353842	0.486592	0.836071	14.526497	1.102743	0.806057	49.693429
min	1.000000	0.000000	1.000000	0.420000	0.000000	0.000000	0.000000
25%	223.500000	0.000000	2.000000	20.125000	0.000000	0.000000	7.910400
50%	446.000000	0.000000	3.000000	28.000000	0.000000	0.000000	14.454200
75%	668.500000	1.000000	3.000000	38.000000	1.000000	0.000000	31.000000
max	891.000000	1.000000	3.000000	80.000000	8.000000	6.000000	512.329200

In [46]:
```python
train_df['Survived'].value_counts()
```

Out[46]:
```
0    549
1    342
Name: Survived, dtype: int64
```

In [47]:
```python
train_df.groupby('Survived').mean()
```

```
/var/folders/nd/q79n0hd51vqcq6swmwgkc95w0000gn/T/ipykernel_43500/2966032617.py:1: FutureWarning: The default va
lue of numeric_only in DataFrameGroupBy.mean is deprecated. In a future version, numeric_only will default to F
alse. Either specify numeric_only or select only columns which should be valid for the function.
  train_df.groupby('Survived').mean()
```

Out[47]:

	PassengerId	Pclass	Age	SibSp	Parch	Fare
Survived						
0	447.016393	2.531876	30.626179	0.553734	0.329690	22.117887
1	444.368421	1.950292	28.343690	0.473684	0.464912	48.395408

In [48]:
```python
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.15, random_state=42)
```

In [49]:
```python
print(X.shape, X_train.shape, X_test.shape)
```

```
(891, 6) (757, 6) (134, 6)
```

In [50]:
```python
print(y.shape, y_train.shape, y_test.shape)
```

```
(891,) (757,) (134,)
```

In [51]:
```python
print(y.mean(), y_train.mean(), y_test.mean())
```

```
0.3838383838383838 0.37780713342140027 0.417910447761194
```

In [52]:
```python
X_train, X_test, y_train, y_test = train_test_split(X, y,
                                                    test_size=0.15,
                                                    stratify = y,
                                                    random_state=42)
```

Stratify is used to return the equal proportions for the class labels of y

In [53]:
```python
print(y.mean(), y_train.mean(), y_test.mean())
```

```
0.3838383838383838 0.3844121532364597 0.3805970149253731
```

In [54]:
```python
print(X.mean(), X_train.mean(), X_test.mean())
```

```
PassengerId    446.000000
Pclass           2.308642
Age             29.699118
SibSp            0.523008
Parch            0.381594
Fare            32.204208
dtype: float64 PassengerId    444.726552
Pclass           2.305152
Age             29.761363
SibSp            0.505945
Parch            0.384412
Fare            31.612147
dtype: float64 PassengerId    453.194030
Pclass           2.328358
Age             29.338095
SibSp            0.619403
Parch            0.365672
Fare            35.548911
dtype: float64
```

In [60]:
```python
x_binarised_train = X_train.apply(pd.cut, bins=2, labels=[1,0])
```

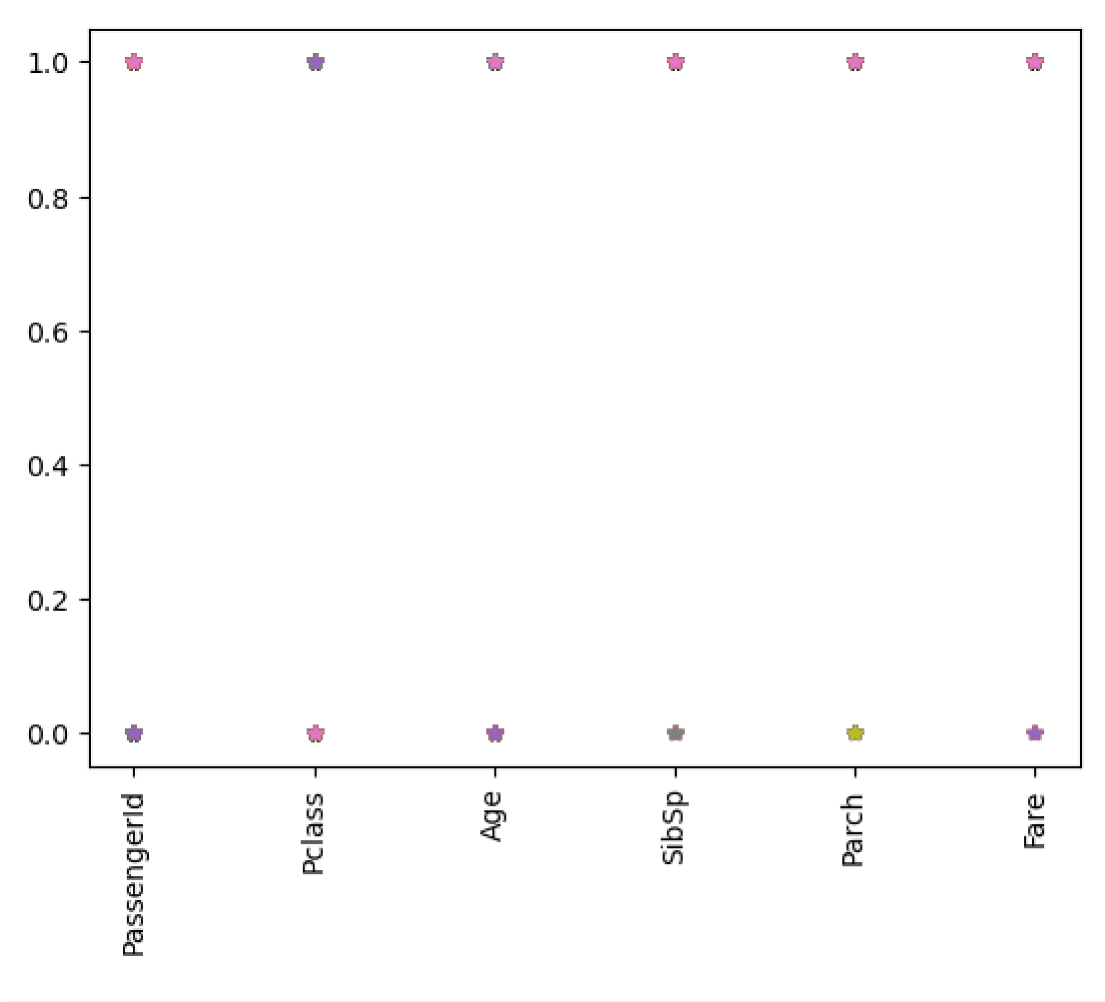
In [61]:
```python
x_binarised_train
```

Out[61]:

	PassengerId	Pclass	Age	SibSp	Parch	Fare
400	1	0	1	1	1	1
122	1	1	1	1	1	1
358	1	0	NaN	1	1	1
626	0	1	0	1	1	1
874	0	1	1	1	1	1
...	...	...	...	...	...	...
537	0	1	1	1	1	1
736	0	0	0	1	1	1
462	0	1	0	1	1	1
347	1	0	NaN	1	1	1
289	1	0	1	1	1	1

757 rows × 6 columns

In [62]:
```python
plt.plot(x_binarised_train.T, '*')
plt.xticks(rotation='vertical')
plt.show()
```



In [63]:
```python
x_binarised_test = X_test.apply(pd.cut, bins=2, labels=[1,0])
```

In [64]:
```python
x_binarised_test = x_binarised_test.values
x_binarised_train = x_binarised_train.values
```

In [65]:
```python
type(x_binarised_train), type(x_binarised_test)
```

Out[65]:
```
(numpy.ndarray, numpy.ndarray)
```

In [71]:
```python
b = 3

i = randint(0, x_binarised_train.shape[0])

print("For row", i)

if (np.sum(x_binarised_train[100, :]) >= b):
    print("MP Neuron inference is Survived")
else:
    print("MP Neuron inference is Not Survived")

if (y_train[i] == 1):
    print("Ground Truth is Survived")
else:
    print("Ground truth is Not Survived")
```

```
For row 524
MP Neuron inference is Survived
Ground truth is Not Survived
```

In [72]:
```python
b = 3

y_pred_train = []
accurate_rows = 0

for x, y in zip(x_binarised_train, y_train):
    y_pred = (np.sum(x) >= b)
    y_pred_train.append(y_pred)
    accurate_rows += (y == y_pred)

print(accurate_rows, accurate_rows/x_binarised_train.shape[0])
```

```
349 0.4610303830911493
```

In [73]:
```python
for b in range(x_binarised_train.shape[1] + 1):
    y_pred_train = []
    accurate_rows = 0

    for x, y in zip(x_binarised_train, y_train):
        y_pred = (np.sum(x) >= b)
        y_pred_train.append(y_pred)
        accurate_rows += (y == y_pred)

    print(b, accurate_rows, accurate_rows/x_binarised_train.shape[0])
```

```
0 347 0.4583883751651255
1 347 0.4583883751651255
2 347 0.4583883751651255
3 349 0.4610303830911493
4 370 0.48877146631439894
5 445 0.5878467635402906
6 483 0.6380449141347424
```

In [82]:
```python
b = 6

y_pred_test = []

for x in x_binarised_test:
    y_pred = (np.sum(x) >= b)
    y_pred_test.append(y_pred)

accuracy = accuracy_score(y_pred_test, y_test)
print(b,accuracy)
```

```
6 0.6492537313432836
```

In [83]:
```python
class MPNeuron:

    def __init__(self):
        self.b = None

    def model(self, x):
        return(sum(x) >= self.b)

    def predict(self, X):
        Y = []
        for x in X:
            result = self.model(x)
            Y.append(result)
        return np.array(Y)

    def fit(self, X, Y):
        accuracy = {}

        for b in range(X.shape[1] + 1):
            self.b = b
            Y_pred = self.predict(X)
            accuracy[b] = accuracy_score(Y_pred, Y)

        best_b = max(accuracy,key = accuracy.get)
        self.b = best_b

        print('Optimal Value of  is', best_b)
        print('Highest accuracy is',accuracy[best_b])
```

In [84]:
```python
mp_neuron = MPNeuron()
mp_neuron.fit(x_binarised_train, y_train)
```

```
Optimal Value of  is 6
Highest accuracy is 0.6380449141347424
```

In [85]:
```python
Y_test_pred = mp_neuron.predict(x_binarised_test)
accuracy_test = accuracy_score(Y_test_pred, y_test)
```

In [86]:
```python
print(accuracy_test)
```

```
0.6492537313432836
```