Titanic Passanger Survival Data

In [2]:
```
import pandas as pd
import numpy as np
```

In [3]:
```
train = pd.read_csv("input/train.csv")
test = pd.read_csv("input/test.csv")
```

In [4]:
```
train.isnull().sum()
print("Train Shape:",train.shape)
test.isnull().sum()
print("Test Shape:",test.shape)
```

```
Train Shape: (891, 12)
Test Shape: (418, 11)
```

In [5]:
```
train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
PassengerId    891 non-null int64
Survived       891 non-null int64
Pclass         891 non-null int64
Name           891 non-null object
Sex            891 non-null object
Age            714 non-null float64
SibSp          891 non-null int64
Parch          891 non-null int64
Ticket         891 non-null object
Fare           891 non-null float64
Cabin          204 non-null object
Embarked       889 non-null object
dtypes: float64(2), int64(5), object(5)
memory usage: 83.6+ KB
```

In [6]:
```
test.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 418 entries, 0 to 417
Data columns (total 11 columns):
PassengerId    418 non-null int64
Pclass         418 non-null int64
Name           418 non-null object
Sex            418 non-null object
Age            332 non-null float64
SibSp          418 non-null int64
Parch          418 non-null int64
Ticket         418 non-null object
Fare           417 non-null float64
Cabin          91 non-null object
Embarked       418 non-null object
dtypes: float64(2), int64(4), object(5)
memory usage: 36.0+ KB
```

Data Dictionary

- Survived: 0 = No, 1 = Yes
- pclass: Ticket class 1 = 1st, 2 = 2nd, 3 = 3rd
- sibsp: # of siblings / spouses aboard the Titanic

- parch: # of parents / children aboard the Titanic
- ticket: Ticket number
- cabin: Cabin number
- embarked: Port of Embarkation C = Cherbourg, Q = Queenstown, S = Southampton

Total rows and columns

We can see that there are 891 rows and 12 columns in our training dataset.

In [7]:
```
train.head(10)
```

Out[7]:

	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
5	6	0	3	Moran, Mr. James	male	NaN	0	0	330877	8.4583	NaN	Q
6	7	0	1	McCarthy, Mr. Timothy J	male	54.0	0	0	17463	51.8625	E46	S
7	8	0	3	Palsson, Master. Gosta Leonard	male	2.0	3	1	349909	21.0750	NaN	S
8	9	1	3	Johnson, Mrs. Oscar W (Elisabeth Vilhelmina Berg)	female	27.0	0	2	347742	11.1333	NaN	S
9	10	1	2	Nasser, Mrs. Nicholas (Adele Achem)	female	14.0	1	0	237736	30.0708	NaN	C

In [8]:
```
train.describe()
```

Out[8]:

	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 [9]:
```
test.describe()
```

Out[9]:

	PassengerId	Pclass	Age	SibSp	Parch	Fare
count	418.000000	418.000000	332.000000	418.000000	418.000000	417.000000
mean	1100.500000	2.265550	30.272590	0.447368	0.392344	35.627188
std	120.810458	0.841838	14.181209	0.896760	0.981429	55.907576
min	892.000000	1.000000	0.170000	0.000000	0.000000	0.000000
25%	996.250000	1.000000	21.000000	0.000000	0.000000	7.895800
50%	1100.500000	3.000000	27.000000	0.000000	0.000000	14.454200
75%	1204.750000	3.000000	39.000000	1.000000	0.000000	31.500000
max	1309.000000	3.000000	76.000000	8.000000	9.000000	512.329200

In [10]:
```
train.isnull().sum()
```

Out[10]:
```
PassengerId      0
Survived         0
Pclass           0
Name             0
Sex              0
Age            177
SibSp            0
Parch            0
Ticket           0
Fare             0
Cabin          687
Embarked         2
dtype: int64
```

In [11]:
```
test.isnull().sum()
test["Survived"] = ""
test.head()
```

Out[11]:

	PassengerId	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Survived
0	892	3	Kelly, Mr. James	male	34.5	0	0	330911	7.8292	NaN	Q	
1	893	3	Wilkes, Mrs. James (Ellen Needs)	female	47.0	1	0	363272	7.0000	NaN	S	

2	894	2	Myles, Mr. Thomas Francis	male	62.0	0	0	240276	9.6875	NaN	Q
3	895	3	Wirz, Mr. Albert	male	27.0	0	0	315154	8.6625	NaN	S
4	896	3	Hirvonen, Mrs. Alexander (Helga E Lindqvist)	female	22.0	1	1	3101298	12.2875	NaN	S

Data Visualization using Matplotlib and Seaborn packages.

In [12]:
```
import matplotlib.pyplot as plt # Plot the graphes
%matplotlib inline
import seaborn as sns
sns.set() # setting seaborn default for plots
```

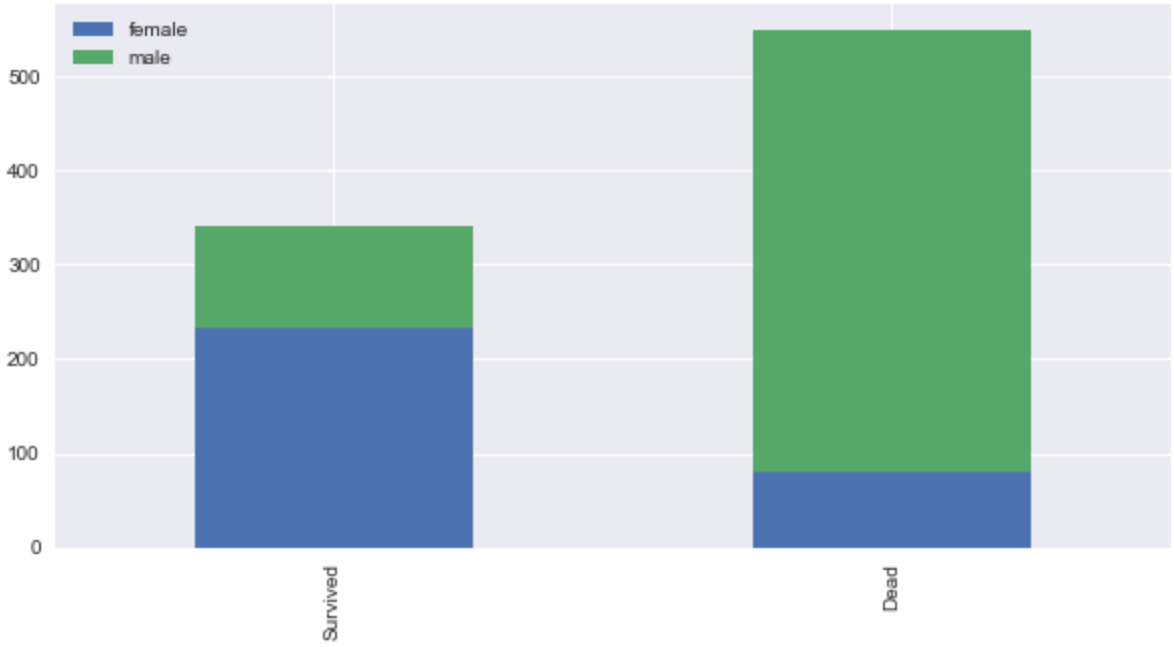
Bar Chart for Categorical Features

- Pclass
- Sex
- SibSp (# of siblings and spouse)
- Parch (# of parents and children)
- Embarked
- Cabin

In [13]:
```
def bar_chart(feature):
    survived = train[train['Survived']==1][feature].value_counts()
    dead = train[train['Survived']==0][feature].value_counts()
    df = pd.DataFrame([survived,dead])
    df.index = ['Survived','Dead']
    df.plot(kind='bar',stacked=True, figsize=(10,5))
```

In [14]:
```
bar_chart('Sex')
print("Survived :\n",train[train['Survived']==1]['Sex'].value_counts())
print("Dead:\n",train[train['Survived']==0]['Sex'].value_counts())
```

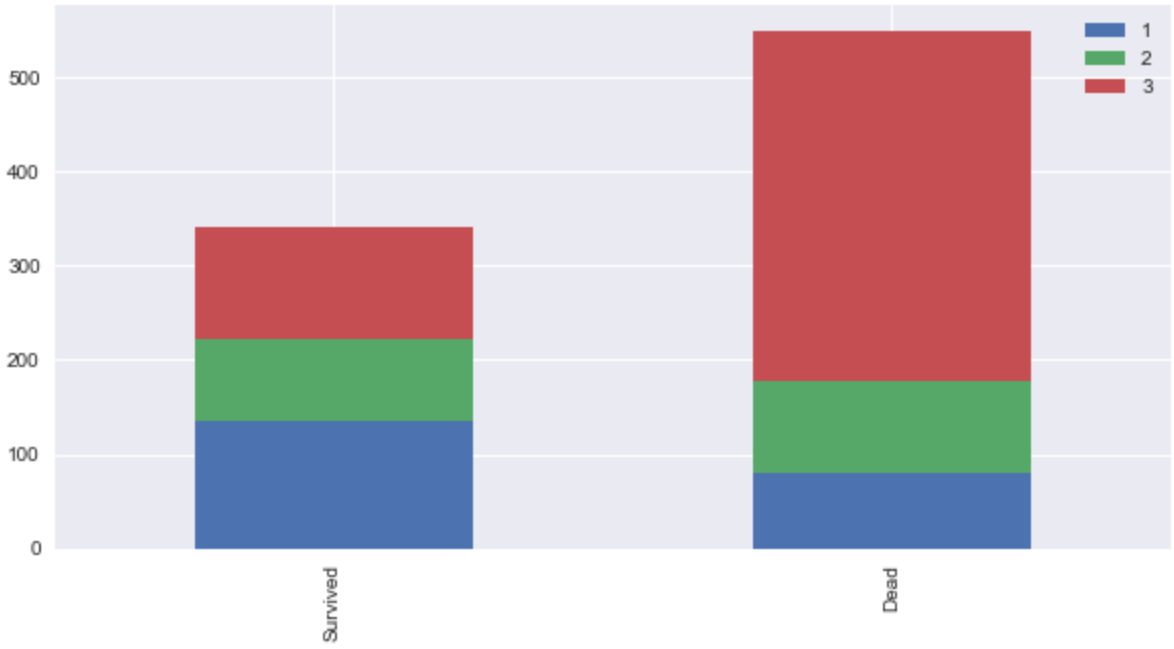
```
Survived :
 female    233
male      109
Name: Sex, dtype: int64
Dead:
 male      468
female     81
Name: Sex, dtype: int64
```



The Chart confirms **Women more likely survivied than Men**.

In [15]:
```
bar_chart('Pclass')
print("Survived :\n",train[train['Survived']==1]['Pclass'].value_counts())
print("Dead:\n",train[train['Survived']==0]['Pclass'].value_counts())
```

```
Survived :
 1    136
3    119
2     87
Name: Pclass, dtype: int64
Dead:
 3    372
2     97
1     80
Name: Pclass, dtype: int64
```



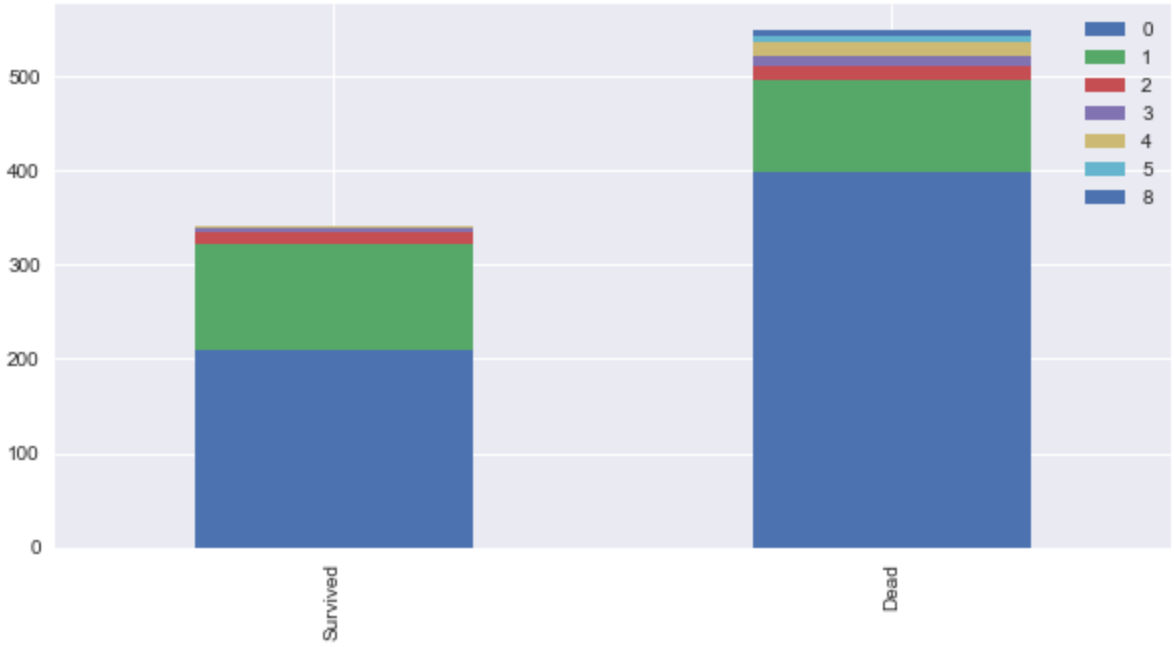
The Chart confirms **1st class** more likely survivied than **other classes**.

The Chart confirms **3rd class** more likely dead than **other classes**

In [16]:
```
bar_chart('SibSp')
print("Survived :\n",train[train['Survived']==1]['SibSp'].value_counts())
```

```
print("Dead:\n",train[train['Survived']==0]['SibSp'].value_counts())
```

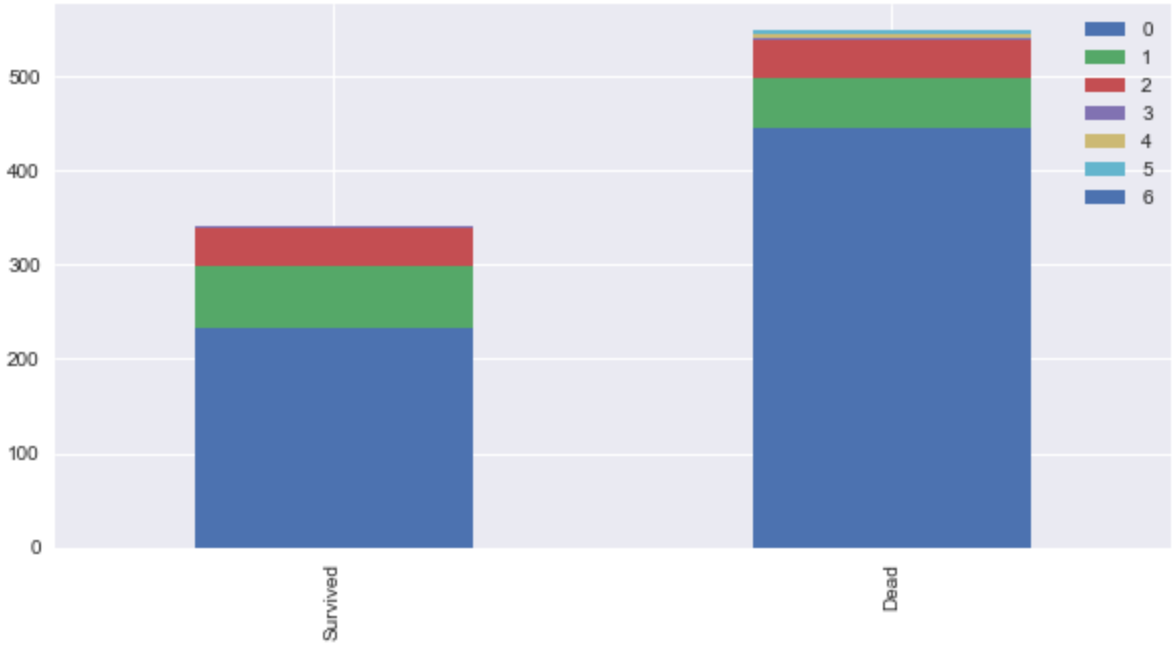
```
Survived :
 0    210
1    112
2     13
3      4
4      3
Name: SibSp, dtype: int64
Dead:
 0    398
1     97
4     15
2     15
3     12
8      7
5      5
Name: SibSp, dtype: int64
```



The Chart confirms a **person aboarded with more than 2 siblings or spouse** more likely survived.
The Chart confirms a **person aboarded without siblings or spouse** more likely dead

In [17]:
```
bar_chart('Parch')
print("Survived :\n",train[train['Survived']==1]['Parch'].value_counts())
print("Dead:\n",train[train['Survived']==0]['Parch'].value_counts())
```

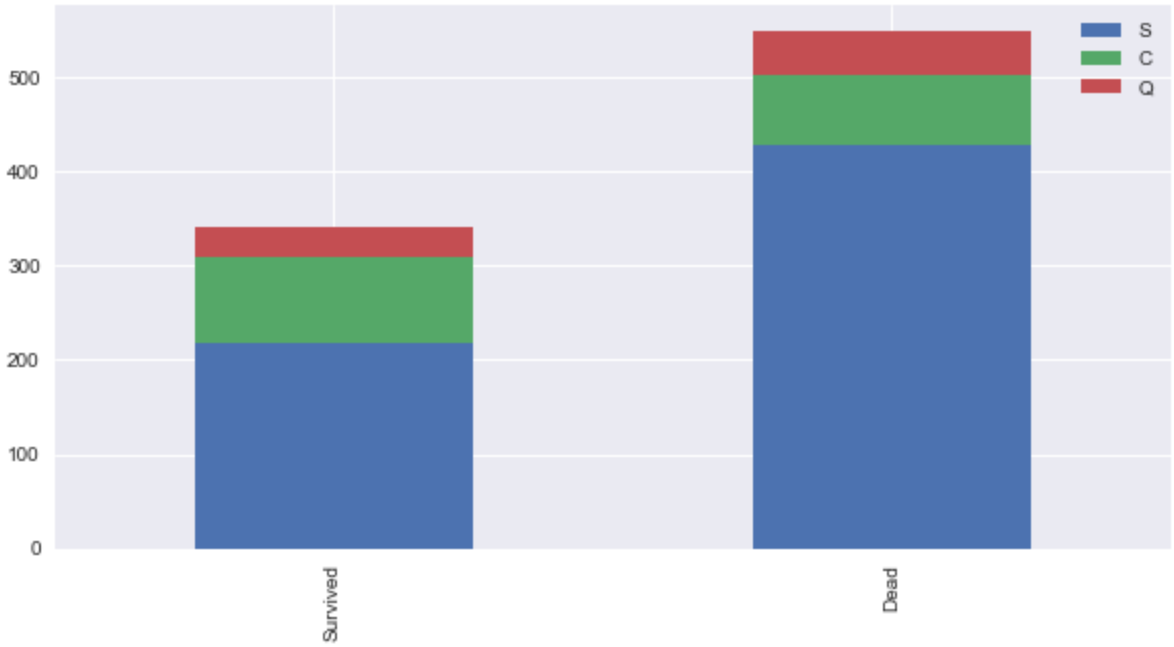
```
Survived :
 0    233
1     65
2     40
3      3
5      1
Name: Parch, dtype: int64
Dead:
 0    445
1     53
2     40
5      4
4      4
3      2
6      1
Name: Parch, dtype: int64
```



The Chart confirms a **person aboarded with more than 2 parents or children more likely survived.**
The Chart confirms a **person aboarded alone more likely dead**

In [18]:
```
bar_chart('Embarked')
print("Survived :\n",train[train['Survived']==1]['Embarked'].value_counts())
print("Dead:\n",train[train['Survived']==0]['Embarked'].value_counts())
```

```
Survived :
 S    217
C     93
Q     30
Name: Embarked, dtype: int64
Dead:
 S    427
C     75
Q     47
Name: Embarked, dtype: int64
```



The Chart confirms a **person aboarded from C** slightly more likely survived.
The Chart confirms a **person aboarded from Q** more likely dead.
The Chart confirms a **person aboarded from S** more likely dead.

Feature engineering is the process of using domain knowledge of the data to create features (**feature vectors**) that make machine learning algorithms work.

feature vector is an n-dimensional vector of numerical features that represent some object. Many algorithms in machine learning require a numerical representation of objects, since such representations facilitate processing and statistical analysis.

In [19]:
```
train.head()
```

Out[19]:

	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 [21]:
```
train.head(10)
```

Out[21]:

	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	male	35.0	0	0	373450	8.0500	NaN	S

				Henry								
5	6	0	3	Moran, Mr. James	male	NaN	0	0	330877	8.4583	NaN	Q
6	7	0	1	McCarthy, Mr. Timothy J	male	54.0	0	0	17463	51.8625	E46	S
7	8	0	3	Palsson, Master. Gosta Leonard	male	2.0	3	1	349909	21.0750	NaN	S
8	9	1	3	Johnson, Mrs. Oscar W (Elisabeth Vilhelmina Berg)	female	27.0	0	2	347742	11.1333	NaN	S
9	10	1	2	Nasser, Mrs. Nicholas (Adele Achem)	female	14.0	1	0	237736	30.0708	NaN	C

In [22]:
```
train_test_data = [train,test] # combine dataset

for dataset in train_test_data:
    dataset['Title'] = dataset['Name'].str.extract(' ([A-Za-z]+)\.', expand=False)
```

In [23]:
```
train['Title'].value_counts()
```

Out[23]:
```
Mr          517
Miss        182
Mrs         125
Master       40
Dr            7
Rev           6
Mlle          2
Col           2
Major         2
Lady          1
Sir           1
Mme           1
Ms            1
Don           1
Countess      1
Capt          1
Jonkheer      1
Name: Title, dtype: int64
```

In [24]:
```
test['Title'].value_counts()
```

Out[24]:
```
Mr        240
Miss       78
Mrs        72
Master     21
Rev         2
Col         2
Dr          1
Ms          1
Dona        1
Name: Title, dtype: int64
```

Title Map

Mr : 0

Miss : 1

Mrs: 2

Others: 3

In [25]:
```
title_mapping = {"Mr": 0, "Miss": 1, "Mrs": 2,
                 "Master": 3, "Dr": 3, "Rev": 3, "Col": 3, "Major": 3, "Mlle": 3,"Counte
                 "Ms": 3, "Lady": 3, "Jonkheer": 3, "Don": 3, "Dona" : 3, "Mme": 3,"Capt

for dataset in train_test_data:
    dataset['Title'] = dataset["Title"].map(title_mapping)
```

In [26]:
```
dataset.head()
```

Out[26]:

	PassengerId	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Survived	Titl
0	892	3	Kelly, Mr. James	male	34.5	0	0	330911	7.8292	NaN	Q		
1	893	3	Wilkes, Mrs. James (Ellen Needs)	female	47.0	1	0	363272	7.0000	NaN	S		
2	894	2	Myles, Mr. Thomas Francis	male	62.0	0	0	240276	9.6875	NaN	Q		
3	895	3	Wirz, Mr. Albert	male	27.0	0	0	315154	8.6625	NaN	S		
4	896	3	Hirvonen, Mrs. Alexander (Helga E Lindqvist)	female	22.0	1	1	3101298	12.2875	NaN	S		

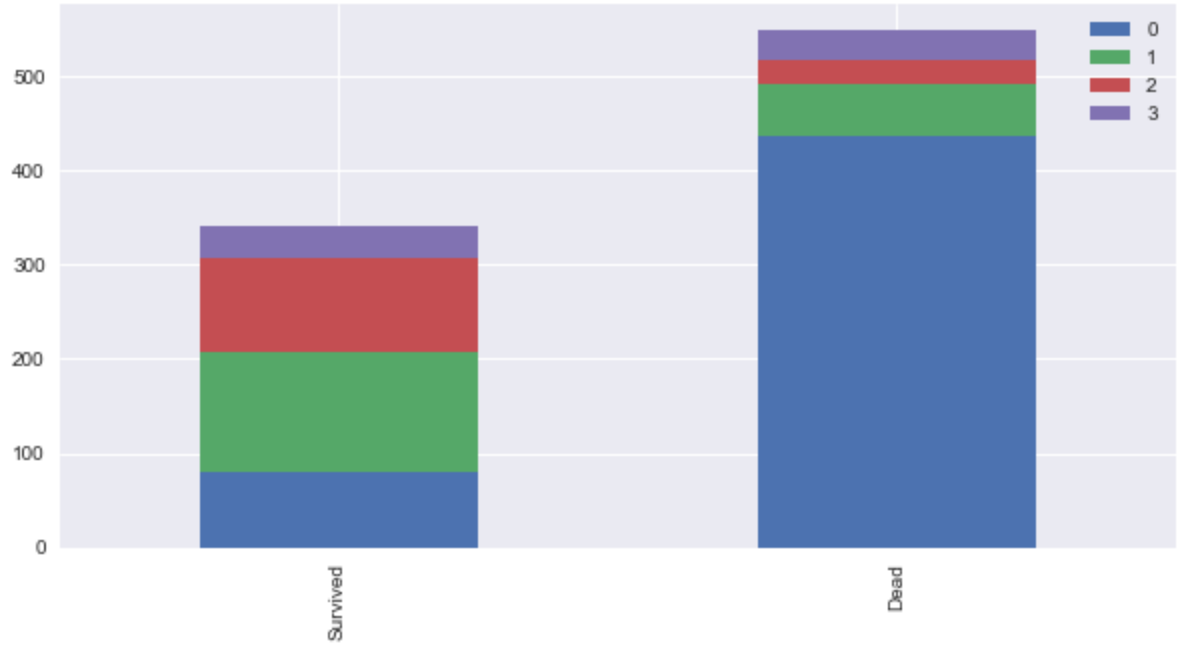
In [27]:
```
test.head()
```

Out[27]:

	PassengerId	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Survived	Titl
0	892	3	Kelly, Mr. James	male	34.5	0	0	330911	7.8292	NaN	Q		
1	893	3	Wilkes, Mrs. James (Ellen Needs)	female	47.0	1	0	363272	7.0000	NaN	S		
2	894	2	Myles, Mr. Thomas Francis	male	62.0	0	0	240276	9.6875	NaN	Q		
3	895	3	Wirz, Mr. Albert	male	27.0	0	0	315154	8.6625	NaN	S		
4	896	3	Hirvonen, Mrs.	female	22.0	1	1	3101298	12.2875	NaN	S		

Alexander (Helga E Lindqvist)

In [28]:
```
bar_chart('Title')
```



In [29]:
```
# delete unnecessary feature from dataset
train.drop('Name', axis=1, inplace=True)
test.drop('Name', axis=1, inplace=True)
```

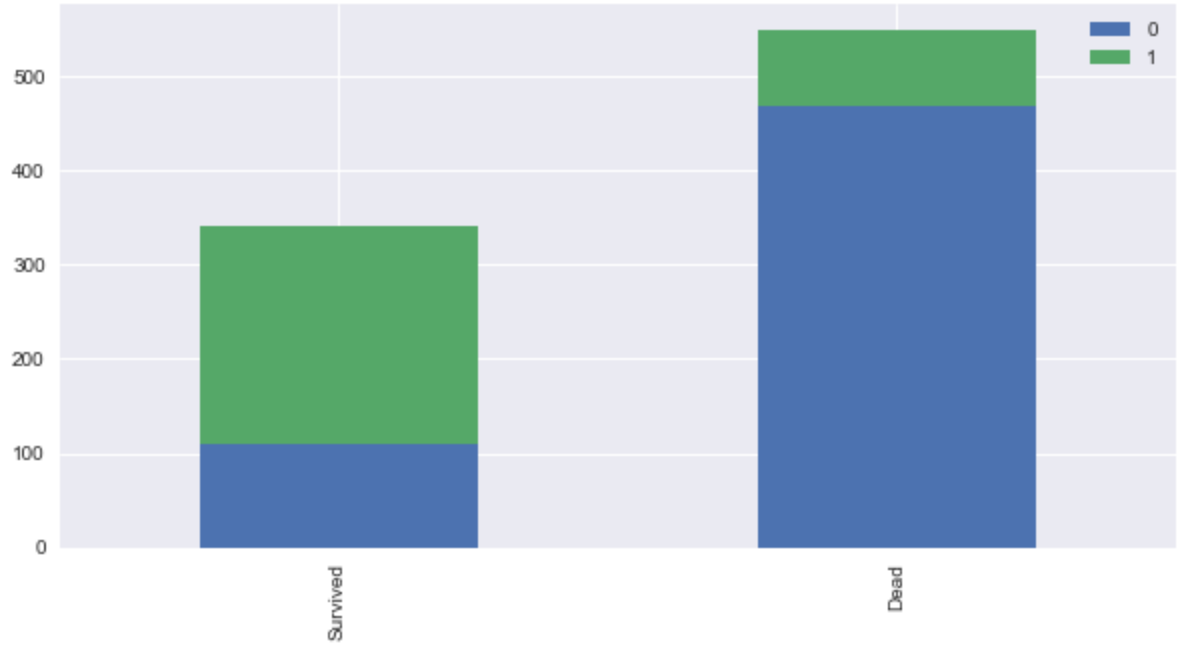
In [30]:
```
train.head()
```

Out[30]:

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Title
0	1	0	3	male	22.0	1	0	A/5 21171	7.2500	NaN	S	0
1	2	1	1	female	38.0	1	0	PC 17599	71.2833	C85	C	2
2	3	1	3	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN	S	1
3	4	1	1	female	35.0	1	0	113803	53.1000	C123	S	2
4	5	0	3	male	35.0	0	0	373450	8.0500	NaN	S	0

In [31]:
```
sex_mapping = {"male": 0, "female": 1}
for dataset in train_test_data:
    dataset['Sex'] = dataset['Sex'].map(sex_mapping)
```

In [32]:
```
bar_chart('Sex')
```



In [33]:
```
test.head()
```

Out[33]:

	PassengerId	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Survived	Title
0	892	3	0	34.5	0	0	330911	7.8292	NaN	Q		0
1	893	3	1	47.0	1	0	363272	7.0000	NaN	S		2
2	894	2	0	62.0	0	0	240276	9.6875	NaN	Q		0
3	895	3	0	27.0	0	0	315154	8.6625	NaN	S		0
4	896	3	1	22.0	1	1	3101298	12.2875	NaN	S		2

In [34]:
```
train["Age"].fillna(train.groupby("Title")["Age"].transform("median"), inplace= True)
test["Age"].fillna(test.groupby('Title')['Age'].transform("median"), inplace= True)
```

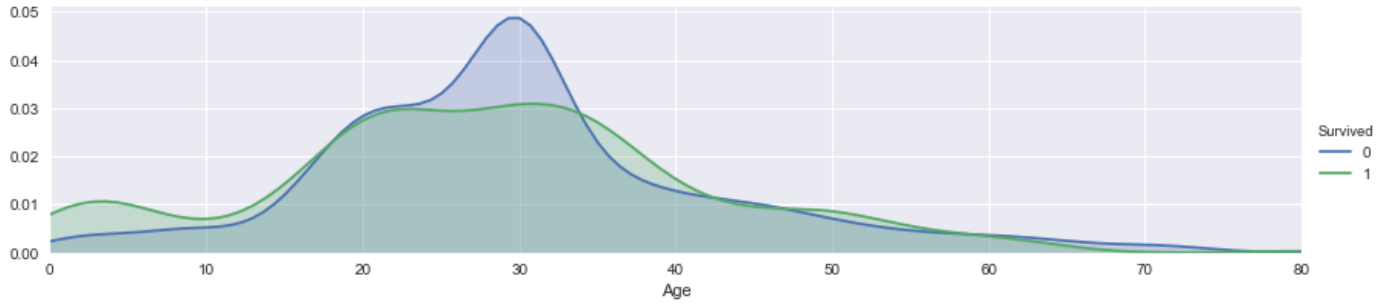
In [35]:
```
train.head(30)
#train.groupby("Title")["Age"].transform("median")
```

Out[35]:

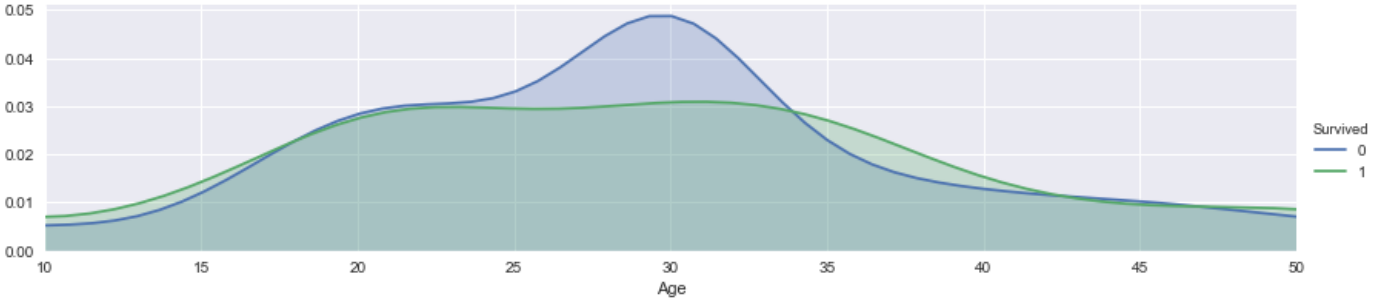
	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Title
0	1	0	3	0	22.0	1	0	A/5 21171	7.2500	NaN	S	0
1	2	1	1	1	38.0	1	0	PC 17599	71.2833	C85	C	2
2	3	1	3	1	26.0	0	0	STON/O2. 3101282	7.9250	NaN	S	1
3	4	1	1	1	35.0	1	0	113803	53.1000	C123	S	2
4	5	0	3	0	35.0	0	0	373450	8.0500	NaN	S	0
5	6	0	3	0	30.0	0	0	330877	8.4583	NaN	Q	0
6	7	0	1	0	54.0	0	0	17463	51.8625	E46	S	0
7	8	0	3	0	2.0	3	1	349909	21.0750	NaN	S	3
8	9	1	3	1	27.0	0	2	347742	11.1333	NaN	S	2
9	10	1	2	1	14.0	1	0	237736	30.0708	NaN	C	2
10	11	1	3	1	4.0	1	1	PP 9549	16.7000	G6	S	1
11	12	1	1	1	58.0	0	0	113783	26.5500	C103	S	1

12	13	0	3	0	20.0	0	0	A/5. 2151	8.0500	NaN	S	0
13	14	0	3	0	39.0	1	5	347082	31.2750	NaN	S	0
14	15	0	3	1	14.0	0	0	350406	7.8542	NaN	S	1
15	16	1	2	1	55.0	0	0	248706	16.0000	NaN	S	2
16	17	0	3	0	2.0	4	1	382652	29.1250	NaN	Q	3
17	18	1	2	0	30.0	0	0	244373	13.0000	NaN	S	0
18	19	0	3	1	31.0	1	0	345763	18.0000	NaN	S	2
19	20	1	3	1	35.0	0	0	2649	7.2250	NaN	C	2
20	21	0	2	0	35.0	0	0	239865	26.0000	NaN	S	0
21	22	1	2	0	34.0	0	0	248698	13.0000	D56	S	0
22	23	1	3	1	15.0	0	0	330923	8.0292	NaN	Q	1
23	24	1	1	0	28.0	0	0	113788	35.5000	A6	S	0
24	25	0	3	1	8.0	3	1	349909	21.0750	NaN	S	1
25	26	1	3	1	38.0	1	5	347077	31.3875	NaN	S	2
26	27	0	3	0	30.0	0	0	2631	7.2250	NaN	C	0
27	28	0	1	0	19.0	3	2	19950	263.0000	C23 C25 C27	S	0
28	29	1	3	1	21.0	0	0	330959	7.8792	NaN	Q	1
29	30	0	3	0	30.0	0	0	349216	7.8958	NaN	S	0

In [36]:
```
facet = sns.FacetGrid(train, hue="Survived",aspect=4)
facet.map(sns.kdeplot,'Age',shade= True)
facet.set(xlim=(0, train['Age'].max()))
facet.add_legend()
plt.show()

facet = sns.FacetGrid(train, hue="Survived",aspect=4)
facet.map(sns.kdeplot,'Age',shade= True)
facet.set(xlim=(0, train['Age'].max()))
facet.add_legend()
plt.xlim(10,50)
```



Out[36]: (10, 50)



Those who were **20 to 30 years old** were **more dead and more survived.**

In [37]:
```
train.info()
test.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
PassengerId    891 non-null int64
Survived       891 non-null int64
Pclass         891 non-null int64
Sex            891 non-null int64
Age            891 non-null float64
SibSp          891 non-null int64
Parch          891 non-null int64
Ticket         891 non-null object
Fare           891 non-null float64
Cabin          204 non-null object
Embarked       889 non-null object
Title          891 non-null int64
dtypes: float64(2), int64(7), object(3)
memory usage: 83.6+ KB
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 418 entries, 0 to 417
Data columns (total 12 columns):
PassengerId    418 non-null int64
Pclass         418 non-null int64
Sex            418 non-null int64
Age            418 non-null float64
SibSp          418 non-null int64
Parch          418 non-null int64
Ticket         418 non-null object
Fare           417 non-null float64
Cabin          91 non-null object
Embarked       418 non-null object
Survived       418 non-null object
Title          418 non-null int64
dtypes: float64(2), int64(6), object(4)
memory usage: 39.3+ KB
```

Binning

Binning/Converting Numerical Age to Categorical Variable

feature vector map:

- child: 0
- young: 1
- adult: 2
- mid-age: 3
- senior: 4

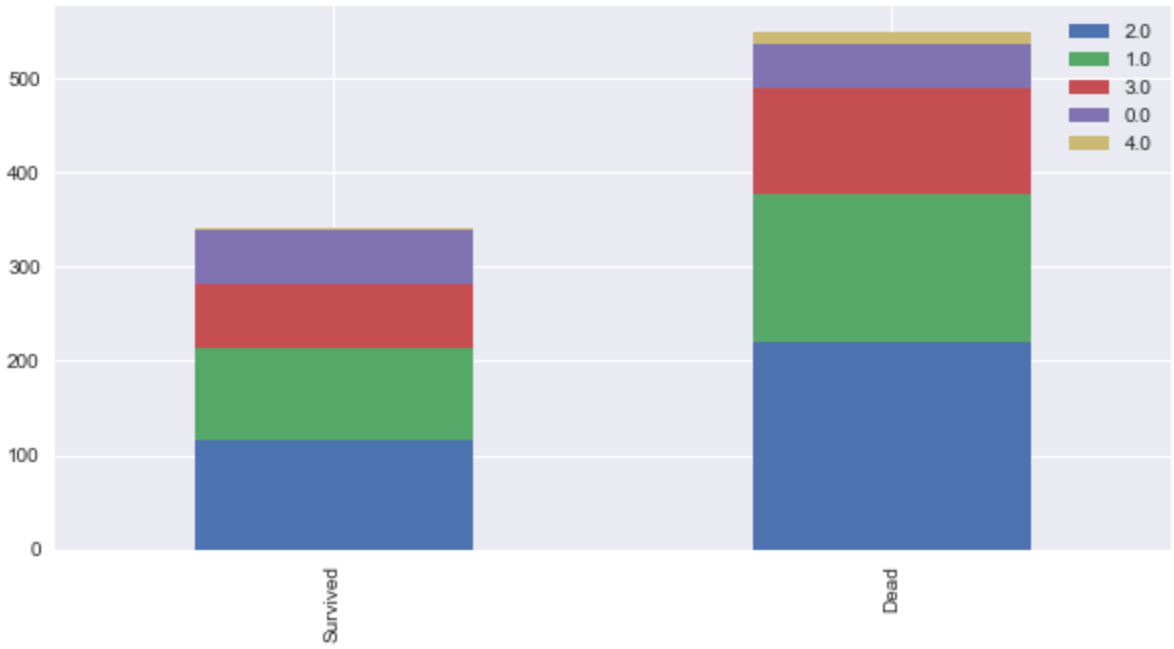
In [38]:
```
train.head()
```

Out[38]:

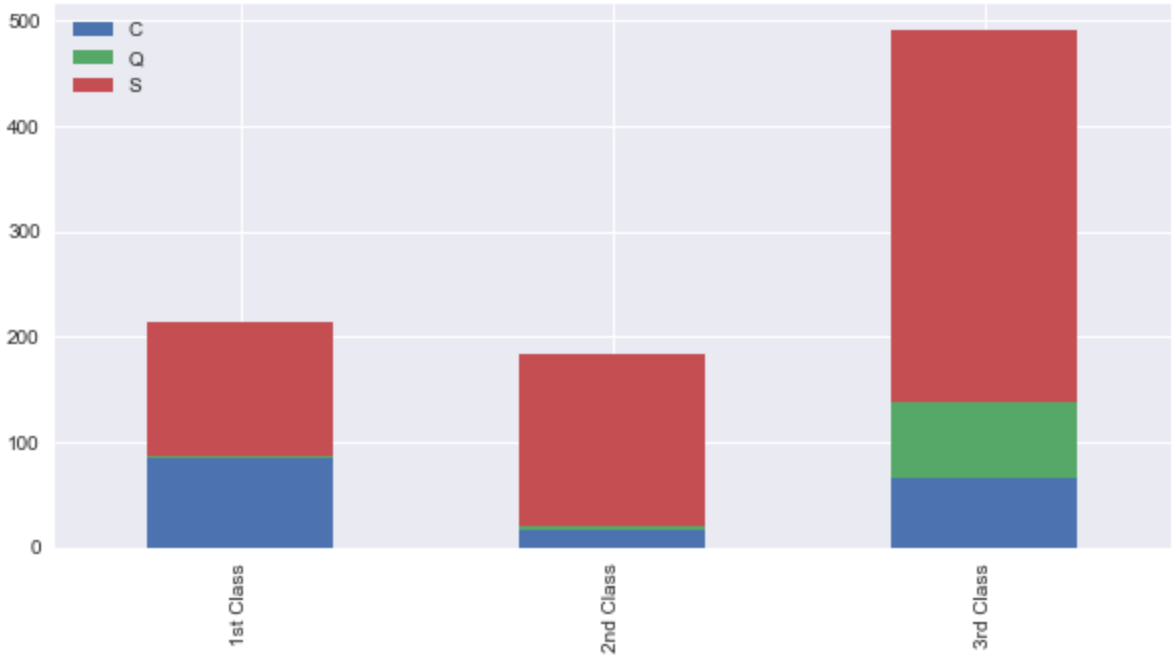
	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Title
0	1	0	3	0	22.0	1	0	A/5 21171	7.2500	NaN	S	0
1	2	1	1	1	38.0	1	0	PC 17599	71.2833	C85	C	2
2	3	1	3	1	26.0	0	0	STON/O2. 3101282	7.9250	NaN	S	1
3	4	1	1	1	35.0	1	0	113803	53.1000	C123	S	2
4	5	0	3	0	35.0	0	0	373450	8.0500	NaN	S	0

In [39]:
```
for dataset in train_test_data:
    dataset.loc[ dataset['Age'] <= 16, 'Age'] = 0,
    dataset.loc[(dataset['Age'] > 16) & (dataset['Age'] <= 26), 'Age'] = 1,
    dataset.loc[(dataset['Age'] > 26) & (dataset['Age'] <= 36), 'Age'] = 2,
    dataset.loc[(dataset['Age'] > 36) & (dataset['Age'] <= 62), 'Age'] = 3,
    dataset.loc[ dataset['Age'] > 62, 'Age'] = 4
# for dataset in train_test_data:
#     dataset.loc[]
#train[train['Age'].isin([23])]
```

In [40]:
```
train.head()
bar_chart('Age')
```



In [41]:
```
Pclass1 = train[train['Pclass'] == 1]['Embarked'].value_counts()
Pclass2 = train[train['Pclass'] == 2]['Embarked'].value_counts()
Pclass3 = train[train['Pclass'] == 3]['Embarked'].value_counts()
df = pd.DataFrame([Pclass1,Pclass2,Pclass3])
df.index = ['1st Class','2nd Class','3rd Class']
df.plot(kind = 'bar', stacked =  True, figsize=(10,5))
plt.show()
print("Pclass1:\n",Pclass1)
print("Pclass2:\n",Pclass2)
print("Pclass3:\n",Pclass3)
```




```
Pclass1:
 S    127
C     85
Q      2
Name: Embarked, dtype: int64
Pclass2:
 S    164
C     17
Q      3
Name: Embarked, dtype: int64
Pclass3:
 S    353
Q     72
C     66
Name: Embarked, dtype: int64
```

more than 50 % of 1st class are from S embark.

more than 50 % of 2st class are from S embark.

more than 50 % of 3st class are from S embark.

fill out missing embark with S embark

In [42]:
```
for dataset in train_test_data:
    dataset['Embarked'] =  dataset['Embarked'].fillna('S')
```

In [43]:
```
train.head()
```

Out[43]:

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Title
0	1	0	3	0	1.0	1	0	A/5 21171	7.2500	NaN	S	0
1	2	1	1	1	3.0	1	0	PC 17599	71.2833	C85	C	2
2	3	1	3	1	1.0	0	0	STON/O2. 3101282	7.9250	NaN	S	1
3	4	1	1	1	2.0	1	0	113803	53.1000	C123	S	2
4	5	0	3	0	2.0	0	0	373450	8.0500	NaN	S	0

In [44]:
```
embarked_mapping = {'S':0,'C':1,'Q':2}
for dataset in train_test_data:
```

```
    dataset['Embarked'] = dataset['Embarked'].map(embarked_mapping)
```

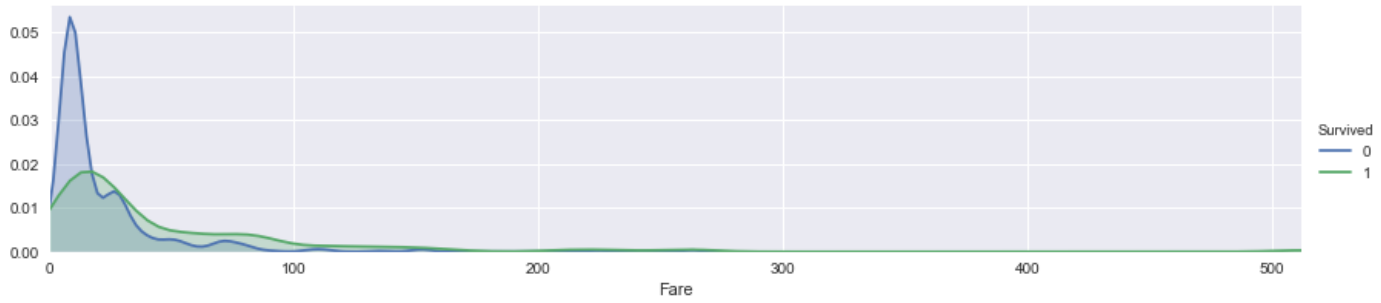
In [45]:
```
# train["Fare"].fillna(train.groupby("Pclass")["Fare"])
# train["Fare"].fillna(train.groupby("Pclass")["Fare"].transform("median"), inplace = Tr
# test["Fare"].fillna(test.groupby("Pclass")["Fare"].transform("median"), inplace = True
# train.head(50)


# fill missing Fare with median fare for each Pclass
train["Fare"].fillna(train.groupby("Pclass")["Fare"].transform("median"), inplace=True)
test["Fare"].fillna(test.groupby("Pclass")["Fare"].transform("median"), inplace=True)
train.head(50)
```

Out[45]:

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Title
0	1	0	3	0	1.0	1	0	A/5 21171	7.2500	NaN	0	0
1	2	1	1	1	3.0	1	0	PC 17599	71.2833	C85	1	2
2	3	1	3	1	1.0	0	0	STON/O2. 3101282	7.9250	NaN	0	1
3	4	1	1	1	2.0	1	0	113803	53.1000	C123	0	2
4	5	0	3	0	2.0	0	0	373450	8.0500	NaN	0	0
5	6	0	3	0	2.0	0	0	330877	8.4583	NaN	2	0
6	7	0	1	0	3.0	0	0	17463	51.8625	E46	0	0
7	8	0	3	0	0.0	3	1	349909	21.0750	NaN	0	3
8	9	1	3	1	2.0	0	2	347742	11.1333	NaN	0	2
9	10	1	2	1	0.0	1	0	237736	30.0708	NaN	1	2
10	11	1	3	1	0.0	1	1	PP 9549	16.7000	G6	0	1
11	12	1	1	1	3.0	0	0	113783	26.5500	C103	0	1
12	13	0	3	0	1.0	0	0	A/5. 2151	8.0500	NaN	0	0
13	14	0	3	0	3.0	1	5	347082	31.2750	NaN	0	0
14	15	0	3	1	0.0	0	0	350406	7.8542	NaN	0	1
15	16	1	2	1	3.0	0	0	248706	16.0000	NaN	0	2
16	17	0	3	0	0.0	4	1	382652	29.1250	NaN	2	3
17	18	1	2	0	2.0	0	0	244373	13.0000	NaN	0	0
18	19	0	3	1	2.0	1	0	345763	18.0000	NaN	0	2
19	20	1	3	1	2.0	0	0	2649	7.2250	NaN	1	2
20	21	0	2	0	2.0	0	0	239865	26.0000	NaN	0	0
21	22	1	2	0	2.0	0	0	248698	13.0000	D56	0	0
22	23	1	3	1	0.0	0	0	330923	8.0292	NaN	2	1
23	24	1	1	0	2.0	0	0	113788	35.5000	A6	0	0
24	25	0	3	1	0.0	3	1	349909	21.0750	NaN	0	1
25	26	1	3	1	3.0	1	5	347077	31.3875	NaN	0	2
26	27	0	3	0	2.0	0	0	2631	7.2250	NaN	1	0
27	28	0	1	0	1.0	3	2	19950	263.0000	C23 C25 C27	0	0

28	29	1	3	1	1.0	0	0	330959	7.8792	NaN	2	1
29	30	0	3	0	2.0	0	0	349216	7.8958	NaN	0	0
30	31	0	1	0	3.0	0	0	PC 17601	27.7208	NaN	1	3
31	32	1	1	1	2.0	1	0	PC 17569	146.5208	B78	1	2
32	33	1	3	1	1.0	0	0	335677	7.7500	NaN	2	1
33	34	0	2	0	4.0	0	0	C.A. 24579	10.5000	NaN	0	0
34	35	0	1	0	2.0	1	0	PC 17604	82.1708	NaN	1	0
35	36	0	1	0	3.0	1	0	113789	52.0000	NaN	0	0
36	37	1	3	0	2.0	0	0	2677	7.2292	NaN	1	0
37	38	0	3	0	1.0	0	0	A./5. 2152	8.0500	NaN	0	0
38	39	0	3	1	1.0	2	0	345764	18.0000	NaN	0	1
39	40	1	3	1	0.0	1	0	2651	11.2417	NaN	1	1
40	41	0	3	1	3.0	1	0	7546	9.4750	NaN	0	2
41	42	0	2	1	2.0	1	0	11668	21.0000	NaN	0	2
42	43	0	3	0	2.0	0	0	349253	7.8958	NaN	1	0
43	44	1	2	1	0.0	1	2	SC/Paris 2123	41.5792	NaN	1	1
44	45	1	3	1	1.0	0	0	330958	7.8792	NaN	2	1
45	46	0	3	0	2.0	0	0	S.C./A.4. 23567	8.0500	NaN	0	0
46	47	0	3	0	2.0	1	0	370371	15.5000	NaN	2	0
47	48	1	3	1	1.0	0	0	14311	7.7500	NaN	2	1
48	49	0	3	0	2.0	2	0	2662	21.6792	NaN	1	0
49	50	0	3	1	1.0	1	0	349237	17.8000	NaN	0	2

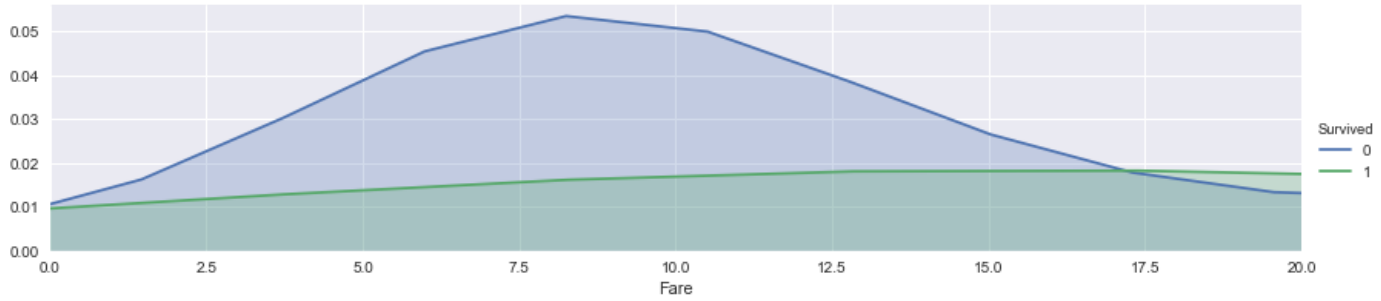
In [46]:
```
facet = sns.FacetGrid(train, hue="Survived",aspect=4 )
facet.map(sns.kdeplot, 'Fare', shade = True)
facet.set(xlim = (0, train['Fare'].max()))
facet.add_legend()
plt.show()
```



In [47]:
```
facet = sns.FacetGrid(train, hue="Survived",aspect=4)
facet.map(sns.kdeplot,'Fare',shade= True)
facet.set(xlim=(0, train['Fare'].max()))
facet.add_legend()
plt.xlim(0, 20)
```

```
(0, 20)
```

Out[47]:



In [48]:
```
for dataset in train_test_data:
    dataset.loc[dataset['Fare'] <= 17, 'Fare'] = 0,
    dataset.loc[(dataset['Fare'] > 17) & (dataset['Fare'] <= 30), 'Fare'] = 1,
    dataset.loc[(dataset['Fare'] > 30) & (dataset['Fare'] <= 100), 'Fare'] = 2,
    dataset.loc[dataset['Fare'] >= 100, 'Fare'] = 3
```

In [49]:
```
train.head()
```

Out[49]:

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Title
0	1	0	3	0	1.0	1	0	A/5 21171	0.0	NaN	0	0
1	2	1	1	1	3.0	1	0	PC 17599	2.0	C85	1	2
2	3	1	3	1	1.0	0	0	STON/O2. 3101282	0.0	NaN	0	1
3	4	1	1	1	2.0	1	0	113803	2.0	C123	0	2
4	5	0	3	0	2.0	0	0	373450	0.0	NaN	0	0

In [50]:
```
train.Cabin.value_counts()
```

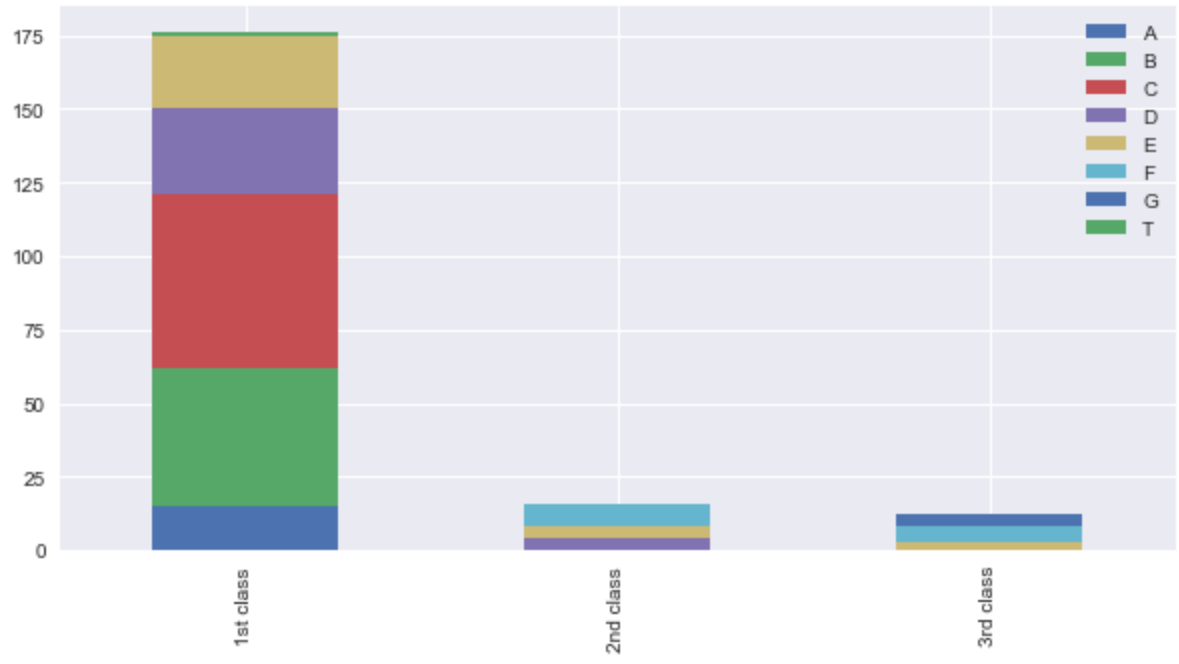
Out[50]:
```
B96 B98            4
G6                 4
C23 C25 C27        4
E101               3
C22 C26            3
D                  3
F2                 3
F33                3
B57 B59 B63 B66    2
E24                2
B20                2
B22                2
D17                2
C92                2
E33                2
E67                2
C52                2
F4                 2
B5                 2
B49                2
C65                2
D36                2
C93                2
C78                2
E25                2
B28                2
D33                2
D20                2
D35                2
B18                2
                  ..
```

```
C62 C64             1
B102                1
E46                 1
B69                 1
E68                 1
C50                 1
C106                1
D28                 1
E50                 1
D46                 1
B19                 1
C47                 1
A24                 1
C70                 1
E36                 1
C86                 1
A34                 1
C111                1
A32                 1
D15                 1
B101                1
A6                  1
B41                 1
B94                 1
B50                 1
E17                 1
C104                1
D56                 1
B78                 1
C95                 1
Name: Cabin, Length: 147, dtype: int64
```

In [51]:
```
for dataset in train_test_data:
    dataset['Cabin'] =  dataset['Cabin'].str[:1]
```

In [52]:
```
Pclass1 = train[train['Pclass']==1]['Cabin'].value_counts()
Pclass2 = train[train['Pclass']==2]['Cabin'].value_counts()
Pclass3 = train[train['Pclass']==3]['Cabin'].value_counts()
df = pd.DataFrame([Pclass1, Pclass2, Pclass3])
df.index = ['1st class','2nd class', '3rd class']
df.plot(kind='bar',stacked=True, figsize=(10,5))
```

Out[52]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x2085f6b8748>
```



In [53]:
```
cabin_mapping = {"A": 0, "B": 0.4, "C": 0.8, "D": 1.2, "E": 1.6, "F": 2, "G": 2.4, "T":
for dataset in train_test_data:
    dataset['Cabin'] = dataset['Cabin'].map(cabin_mapping)
```

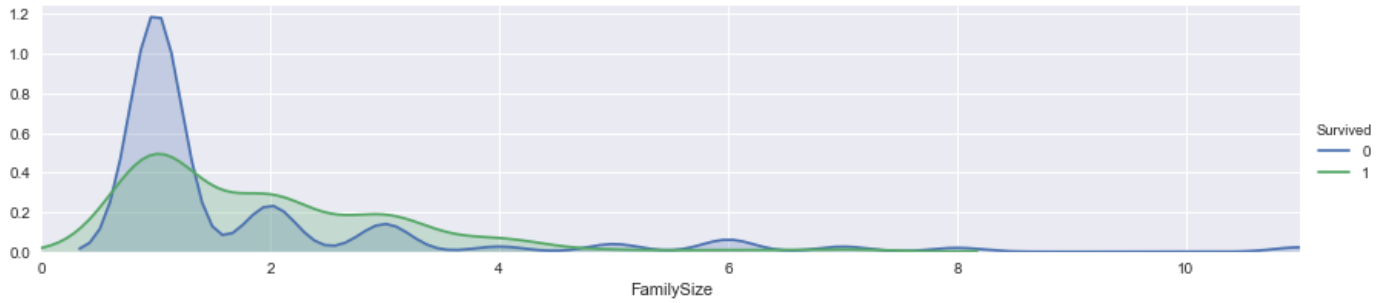
In [54]:
```
# fill missing Fare with median fare for each Pclass
train["Cabin"].fillna(train.groupby("Pclass")["Cabin"].transform("median"), inplace=True
test["Cabin"].fillna(test.groupby("Pclass")["Cabin"].transform("median"), inplace=True)
```

family Size

In [55]:
```
train["FamilySize"] = train["SibSp"] + train["Parch"] + 1
test["FamilySize"] = test["SibSp"] + test["Parch"] + 1
```

In [56]:
```
facet = sns.FacetGrid(train, hue="Survived",aspect=4)
facet.map(sns.kdeplot,'FamilySize',shade= True)
facet.set(xlim=(0, train['FamilySize'].max()))
facet.add_legend()
plt.xlim(0)
```

Out[56]:
```
(0, 11.0)
```



In [57]:
```
family_mapping = {1: 0, 2: 0.4, 3: 0.8, 4: 1.2, 5: 1.6, 6: 2, 7: 2.4, 8: 2.8, 9: 3.2, 10
for dataset in train_test_data:
    dataset['FamilySize'] = dataset['FamilySize'].map(family_mapping)
```

In [58]:
```
train.head()
```

Out[58]:

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Title	FamilySize
0	1	0	3	0	1.0	1	0	A/5 21171	0.0	2.0	0	0	0.4
1	2	1	1	1	3.0	1	0	PC 17599	2.0	0.8	1	2	0.4
2	3	1	3	1	1.0	0	0	STON/O2. 3101282	0.0	2.0	0	1	0.0
3	4	1	1	1	2.0	1	0	113803	2.0	0.8	0	2	0.4
4	5	0	3	0	2.0	0	0	373450	0.0	2.0	0	0	0.0

In [59]:
```
features_drop = ['Ticket','SibSp','Parch']
train = train.drop(features_drop, axis = 1)
test = test.drop(features_drop,axis=1)
train = train.drop(['PassengerId'], axis=1)
```

In [60]:
```
train_data = train.drop('Survived', axis = 1)
target = train['Survived']
train_data.shape, target.shape
```

Out[60]:
```
((891, 8), (891,))
```

In [61]:
```
train_data.head(10)
```

Out[61]:

	Pclass	Sex	Age	Fare	Cabin	Embarked	Title	FamilySize
0	3	0	1.0	0.0	2.0	0	0	0.4
1	1	1	3.0	2.0	0.8	1	2	0.4
2	3	1	1.0	0.0	2.0	0	1	0.0
3	1	1	2.0	2.0	0.8	0	2	0.4
4	3	0	2.0	0.0	2.0	0	0	0.0
5	3	0	2.0	0.0	2.0	2	0	0.0
6	1	0	3.0	2.0	1.6	0	0	0.0
7	3	0	0.0	1.0	2.0	0	3	1.6
8	3	1	2.0	0.0	2.0	0	2	0.8
9	2	1	0.0	2.0	1.8	1	2	0.4

In [62]:
```
# Importing Classifier Modules
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier,ExtraTreeClassifier
from sklearn.ensemble import RandomForestClassifier,ExtraTreesClassifier,BaggingClassifi
from sklearn.naive_bayes import GaussianNB
from sklearn.svm import SVC

import numpy as np
```

In [63]:
```
train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 9 columns):
Survived      891 non-null int64
Pclass        891 non-null int64
Sex           891 non-null int64
Age           891 non-null float64
Fare          891 non-null float64
Cabin         891 non-null float64
Embarked      891 non-null int64
Title         891 non-null int64
FamilySize    891 non-null float64
dtypes: float64(4), int64(5)
memory usage: 62.7 KB
```

In [64]:
```
from sklearn.model_selection import KFold
from sklearn.model_selection import cross_val_score
k_fold = KFold(n_splits=10, shuffle=True, random_state=0)
```

In [65]:
```
clf = KNeighborsClassifier(n_neighbors = 13)
scoring = 'accuracy'
score = cross_val_score(clf, train_data, target, cv=k_fold, n_jobs=1, scoring=scoring)
print(score)
```

```
[0.82222222 0.76404494 0.80898876 0.83146067 0.87640449 0.82022472
 0.85393258 0.79775281 0.84269663 0.84269663]
```

In [66]:
```
#learning_rates = [0.05, 0.1, 0.25, 0.5, 0.75, 1]
clf = [KNeighborsClassifier(n_neighbors = 13),DecisionTreeClassifier(),
       RandomForestClassifier(n_estimators=13),GaussianNB(),SVC(),ExtraTreeClassifier(),
      GradientBoostingClassifier(n_estimators=10, learning_rate=1,max_features=3, max_de
```

```
def model_fit():
    scoring = 'accuracy'
    for i in range(len(clf)):
        score = cross_val_score(clf[i], train_data, target, cv=k_fold, n_jobs=1, scoring
        print("Score of Model",i,":",round(np.mean(score)*100,2))
#     round(np.mean(score)*100,2)
#     print("Score of :\n",score)
model_fit()
```

```
Score of Model 0 : 82.6
Score of Model 1 : 79.8
Score of Model 2 : 80.92
Score of Model 3 : 78.78
Score of Model 4 : 83.5
Score of Model 5 : 80.02
Score of Model 6 : 81.25
Score of Model 7 : 81.03
Score of Model 8 : 80.7
```

In [ ]:
```
clf1 = SVC()
clf1.fit(train_data, target)
test
test_data = test.drop(['Survived','PassengerId'], axis=1)
prediction = clf1.predict(test_data)
# test_data
```

In [ ]:
```
test_data['Survived'] = prediction
submission = pd.DataFrame(test['PassengerId'],test_data['Survived'])
submission.to_csv("Submission.csv")
```

In [ ]:
```

```