Investigate Titanic Dataset

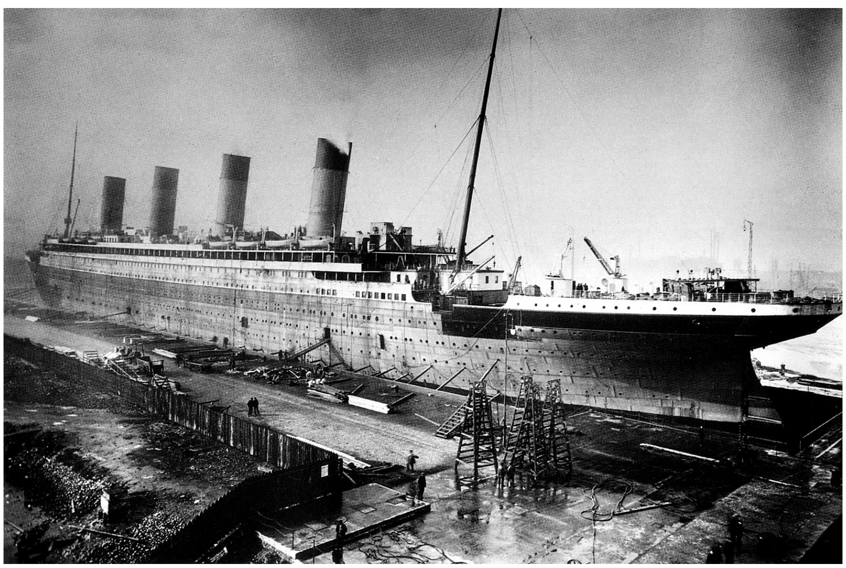
1. Introduction

RMS Titanic was a British passenger liner that sank in the North Atlantic Ocean in the early morning of 15 April 1912, after colliding with an iceberg during her maiden voyage from Southampton to New York City. Of the 2,224 passengers and crew aboard, more than 1,500 died in the sinking, making it one of the deadliest commercial peacetime maritime disasters in modern history. Passengers and some crew members were evacuated in lifeboats and many of them were launched only partially loaded. There were not enought lifeboats for all the passangers and due to the ocean water temperature it was not possible to survive long time in the water.

As a side note on the night the Titanic sank, the recorded water temperature in the North Atlantic was registered at approx 30 degrees Fahrenheit. Water temperatures between 32 and 40 degrees Fahrenheit cause hypothermia, reducing body temperature below 95 degrees Fahrenheit. Hypothermia results in death within 30 to 90 minutes.

In [184]:
```
#Load image from url
from IPython.display import Image
from IPython.core.display import HTML
Image(url= "https://upload.wikimedia.org/wikipedia/commons/e/e1/Titanic_under_construction.jpg",
 width=500, height=500, unconfined=True)
```

Out[184]:



2. About the dataset

The dataset of study contains demographics and passenger information from 891 of the 2224 passengers and crew on board the Titanic. The variables included are:

Source of the data: https://www.kaggle.com/c/titanic VARIABLE DESCRIPTIONS: survival Survival (0 = No; 1 = Yes) pclass Passenger Class (1 = 1st; 2 = 2nd; 3 = 3rd) name Name sex Sex age Age sibsp Number of Siblings/Spouses Aboard parch Number of Parents/Children Aboard ticket Ticket Number fare Passenger Fare cabin Cabin embarked Port of Embarkation (C = Cherbourg; Q = Queenstown; S = Southampton) SPECIAL NOTES: Pclass is a proxy for socio-economic status (SES) * 1st: Upper * 2nd: Middle * 3rd: Lower Age is in Years; Fractional if Age less than One (1) If the Age is Estimated, it is in the form xx.5 With respect to the family relation variables (i.e. sibsp and parch) some relations were ignored. The following are the definitions used for sibsp and parch. Sibling: Brother, Sister, Stepbrother, or Stepsister of Passenger Aboard Titanic Spouse: Husband or Wife of Passenger Aboard Titanic (Mistresses and Fiances Ignored) Parent: Mother or Father of Passenger Aboard Titanic Child: Son, Daughter, Stepson, or Stepdaughter of Passenger Aboard Titanic Other family relatives excluded from this study include cousins, nephews/nieces, aunts/uncles, and in-laws. Some children travelled only with a nanny, therefore parch=0 for them. As well, some travelled with very close friends or neighbors in a village, however, the definitions do not support such relations.

In this project i will asses which factors had influence on chances of survival of the passangers. In my analysis i will take into the consideration data such as: age, cabin, location where the passanger embarked, sex. After assesing the data i will try to answer following questions?

- It's true in this case the phrase 'women and children first'? Did woman and children had higher chance of survival?
- Did the survival chance depended on the age of the passanger? Did young people have higher chance of survival?
- Had first class passengers more chances of survival?
- Did the survival chance depended on location of embarkment of the passangers?
- Did the survival chance depended on which deck passangers were located?

3. Analysis and data cleaning of the provided data

I will start from importing all necesary modules.

3.1 Data loading

In [185]:

```
#importing all required modules
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%pylab inline
```

```
Populating the interactive namespace from numpy and matplotlib
```

Provided titanic dataset is in cvs format so i will convert it pandas DataFrame.

	PassengerId	Survived	PClass	Age	SibSp	ParCh	Fare

In [186]:
```
# Read csv into Pandas Dataframe and store in dataset variable
titanic_df = pd.read_csv('titanic_data.csv')
titanic_df.head()
```

Out[186]:

	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 [187]:
```
#Renaming columns to follow CamelCase Python practice
titanic_df = titanic_df.rename(columns={"Parch":"ParCh", "Pclass":"PClass"})
```

3.2 Assesing data

In [188]:
```
#Viewing count and other statistical properties of the titanic dataset
titanic_df.describe()
```

Out[188]:

	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	NaN	0.000000	0.000000	7.910400
50%	446.000000	0.000000	3.000000	NaN	0.000000	0.000000	14.454200
75%	668.500000	1.000000	3.000000	NaN	1.000000	0.000000	31.000000
max	891.000000	1.000000	3.000000	80.000000	8.000000	6.000000	512.329200

From the info function output we can already observe that certain data is missing. I will assess now how much data is missing in different columns and how it will affect the analysis.

I have also decided to change "Survived" column to bolean type. It will make plotting of the data easier in the later stage.

3.3 Calculating missing data in the dataset

Now i will calculate number of missing data:

In [189]:
```
#Calculating total number of passangers(rows)
total_pass = len(titanic_df)
print "Total passanger count = ", total_pass

#Removing all the passangers(rows) with missing data
cleaned_data =len(titanic_df.dropna())
print "Available data after removing missing values = ", cleaned_data

#Calculating numer of passangers with all data available
missing = total_pass - cleaned_data
print "Missing data (if at least one type of data is missing in the row) = ", missing

#Calculating percentage of missing data
percent_missssing_data = (missing * 100) / total_pass
print "Procent of missing data in titanic_df = ", percent_missssing_data, "%"
```

```
Total passanger count =  891
Available data after removing missing values =  183
Missing data (if at least one type of data is missing in the row) =  708
Procent of missing data in titanic_df =  79 %
```

We can observe that 79% of the data entries in the Titanic dataset are missing. This is quite big procentage of missing data and it will make the analysis of provided dataset more difficoult.

Now i will asses missing data in each column.

In [190]:
```
#Calculating missing values in each column
def missing_data(titanic_df,columnStr):
    missing_cabindata_rows = len(titanic_df[columnStr]) - titanic_df[columnStr].count()
    return '{} {} = {}'.format('Missing Rows in',columnStr, missing_cabindata_rows)

print missing_data(titanic_df,'Age')
print missing_data(titanic_df,'Cabin')
print missing_data(titanic_df,'Embarked')
print missing_data(titanic_df,'PClass')
print missing_data(titanic_df,'Fare')
print missing_data(titanic_df,'ParCh')
print missing_data(titanic_df,'SibSp')
```

```
Missing Rows in Age = 177
Missing Rows in Cabin = 687
Missing Rows in Embarked = 2
Missing Rows in PClass = 0
Missing Rows in Fare = 0
Missing Rows in ParCh = 0
Missing Rows in SibSp = 0
```

We can observe that we are missing the most data points in Age and Cabin Column.

3.4 Creating new DataFrames for columns with missing data

Since quite a lot of data is missing in different columns i have decided to create new dataframe for them after removing all missing rows. I will also create number of different DataFrames. In my opinion this is the best way to make sure that we have maximum number of data points testing different hypothesis.

Age of the passangers

Below i will try to asses how many rows have no data in Age column.

In [191]:
```
#Assesing missing rows in Age column
missing_age = missing_data(titanic_df,'Age')
print missing_age
```

```
Missing Rows in Age = 177
```

In [192]:
```
#Calculating percentage of missing data
percent_misssing_age_data = (177 * 100) / total_pass
print "Procent of missing Age data in titanic_df = ", percent_misssing_age_data, "%"
```

```
Procent of missing Age data in titanic_df =  19 %
```

There are 177 missing data in row of Age column which represents 19% of total amount of the data.

Now i will create age Dataframe (after removing rows with missing data).

In [193]:
```
# Create DataFrame with ages handled, remove any missing / use interpolation
known_age_passengers = titanic_df[titanic_df["Age"].notnull()]
print "Records after removing missing ages:", len(known_age_passengers)
```

```
Records after removing missing ages: 714
```

Cabin

Below i will try to asses how many rows have no data in Cabin column.

In [194]:
```
#Assesing missing rows in Age column
print missing_data(titanic_df,'Cabin')
```

```
Missing Rows in Cabin = 687
```

In [195]:
```
#Calculating percentage of missing data
percent_misssing_cabin_data = (687 * 100) / total_pass
print "Procent of missing Cabin data in titanic_df = ", percent_misssing_cabin_data, "%"
```

```
Procent of missing Cabin data in titanic_df =  77 %
```

In [196]:
```
# Creating DataFrame with missing Cabin data removed
known_cabin_passengers = titanic_df.dropna(subset = ["Cabin"])
print "Known cabin passengers count: ", len(known_cabin_passengers)
```

```
Known cabin passengers count:  204
```

In [197]:
```
#Creating a series containing lists of cabins
split_cabins = known_cabin_passengers["Cabin"].str.split(" ")
#Splitting the lists in multiple rows
split_cabins = split_cabins.apply(pd.Series, 1).stack()
#Deleting the extra index column
split_cabins.index = split_cabins.index.droplevel(-1)
split_cabins.name = "Cabin"

#Deleting original cabin column
del known_cabin_passengers["Cabin"]
#Insert new column
known_cabin_passengers = known_cabin_passengers.join(split_cabins)
```

In [198]:
```
decks = known_cabin_passengers["Cabin"].str[0]
decks.name = "Deck"

cabins = known_cabin_passengers["Cabin"].str[1:]
cabins.name = "Cabin"

del known_cabin_passengers["Cabin"]
known_cabin_passengers = pd.concat([known_cabin_passengers, decks, cabins], join="inner",
axis=1)
```

In [199]:
```
#Displaying part of edited dataframe including splited Cabin data
known_cabin_passengers.head()
```

Out[199]:

	PassengerId	Survived	PClass	Name	Sex	Age	SibSp	ParCh	Ticket	Fare	Embarked	Deck
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C	C
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	S	C
6	7	0	1	McCarthy, Mr. Timothy J	male	54.0	0	0	17463	51.8625	S	E
10	11	1	3	Sandstrom, Miss. Marguerite Rut	female	4.0	1	1	PP 9549	16.7000	S	G
11	12	1	1	Bonnell, Miss. Elizabeth	female	58.0	0	0	113783	26.5500	S	C

Port of Embarkation

In [200]:
```
#Assesing missing rows in Embarked column
print missing_data(titanic_df,'Embarked')
```

```
Missing Rows in Embarked = 2
```

In [201]:
```
# Creating DataFrame with Point of Embarkation mising values removed
available_embarked_passengers = titanic_df.dropna(subset = ['Embarked'])
print "Records after removing missing ports of embarkation:", len(available_embarked_passengers)
```

```
Records after removing missing ports of embarkation: 889
```

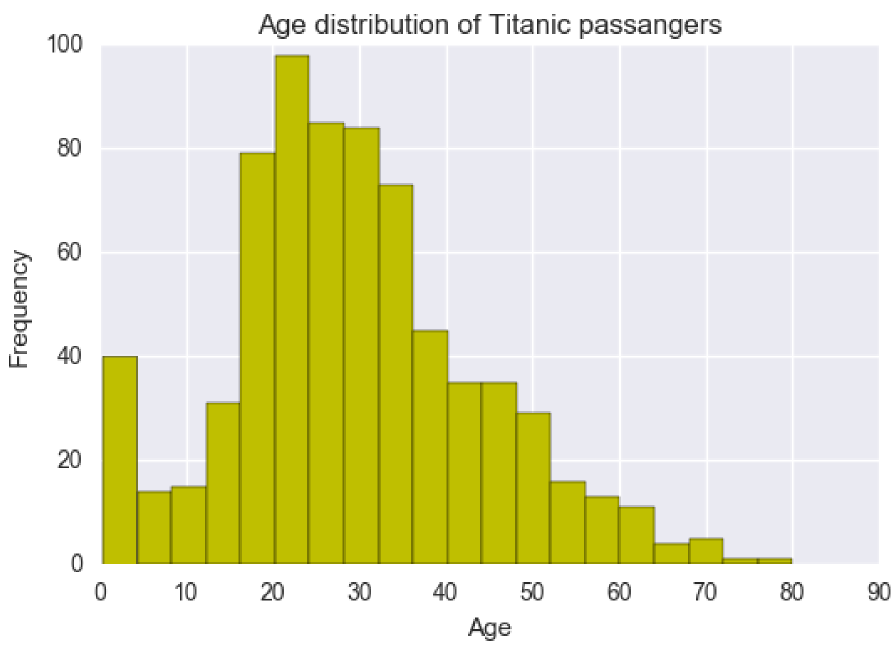
4. Exploring dataset

Here I adressed the questions I asked in the introduction, and I answered them based on the data, I also made some visualizations to help understanding the given numbers.

4.1 Exploring age data

No i will explore age data. I will start with displaying frequency distribution of age data using histogram.

In [202]:
```
#Create histrogram of frequency distribution of age data
known_age_passengers["Age"].hist(bins=20, color="y")
plt.legend(prop={"size":15})
plt.xlabel('Age')
plt.ylabel('Frequency')
plt.title('Age distribution of Titanic passangers')
plt.show()
```



In [203]:
```
#Show statistics of available age data
known_age_passengers["Age"].describe()
```

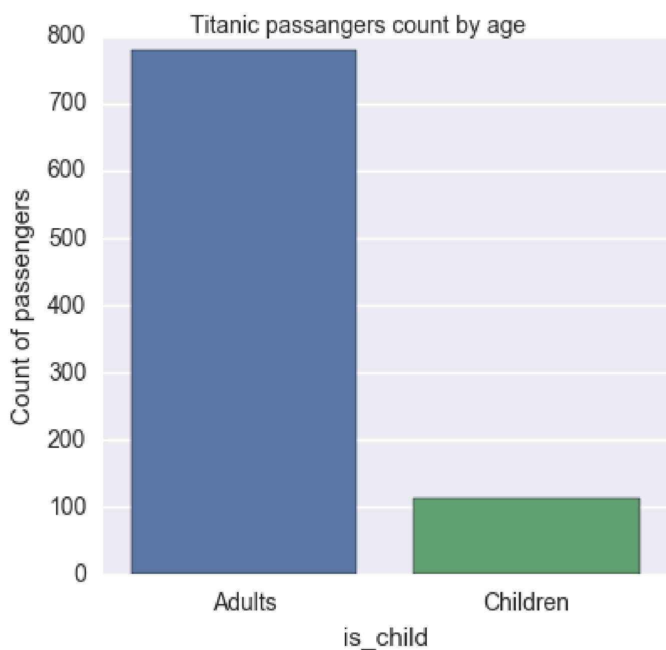
Out[203]:
```
count    714.000000
mean      29.699118
std       14.526497
min        0.420000
25%       20.125000
50%       28.000000
75%       38.000000
max       80.000000
Name: Age, dtype: float64
```

We can conclude following things from above presented table:

```
* average age of the passangers was 29.6 years with standard deviations of 14.5
* maximum passanger age was 80 years and minimum 3 moths
```

In [204]:
```
#Assesing if a passanger is less than 18 years old (then consider to be a child)
def is_child(passanger):
    if passanger < 18:
        return 1
    else:
        return 0

#Adding additonal column "is_child" in titanic_df Dataframe
titanic_df["is_child"] = pd.Series(titanic_df["Age"].apply(is_child), index=titanic_df.index)

#Changing is_child columns to bool type
titanic_df.loc["is_child"] = titanic_df["is_child"].astype(bool)

#Mapping value 1 to Child and 0 to an Adult
titanic_df["is_child"]= titanic_df.is_child.map({1:'Children', 0:'Adults'})

#Creating plot of number of children and adults onboard of titanic
age_plot = sns.factorplot('is_child', data=titanic_df, kind='count')
age_plot.despine(left=True)
age_plot.set_ylabels("Count of passengers")
age_plot.fig.suptitle('Titanic passangers count by age')
```

Out[204]:
```
<matplotlib.text.Text at 0x1af31a20>
```



In [205]:
```
#Number of adults and childrens 1:'Child', 0:'Adult'
titanic_df["is_child"].value_counts()
```

Out[205]:
```
Adults      778
Children    113
Name: is_child, dtype: int64
```

There were 779 adults and 113 children onboard of titanic.

		Age	Fare	PClass	ParCh	PassengerId	SibSp	Survived
Sex								

4.2 Exploring sex data

Now i will explore Sex data. I will start with displaying statistics of sex data:

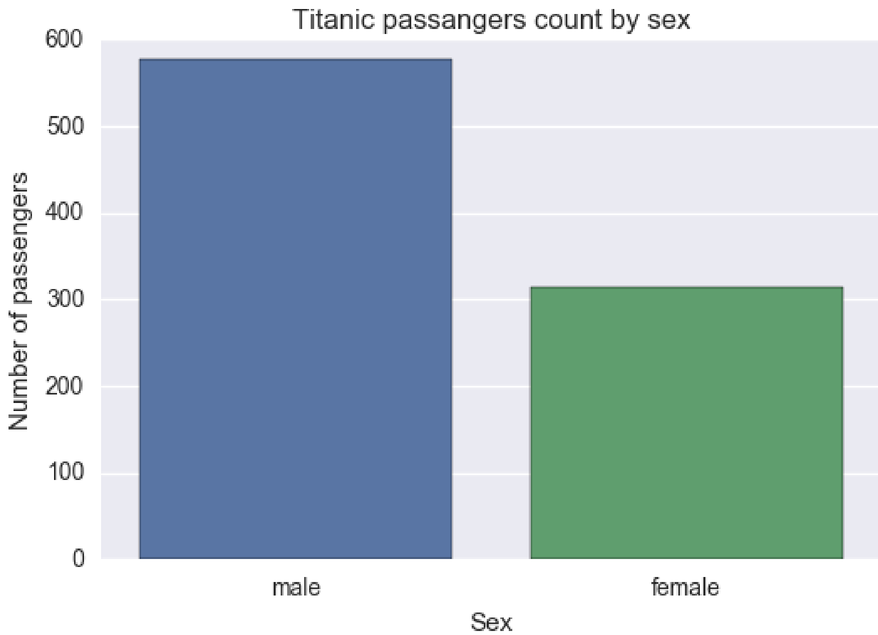
In [206]:
```
# Group series
passengers_by_sex = titanic_df.groupby("Sex")
#Generate various summary statistics of 'Sex' data
passengers_by_sex.describe()
```

Out[206]:

		Age	Fare	PClass	ParCh	PassengerId	SibSp	Survived
Sex								
female	**count**	261.000000	314.000000	314.000000	314.000000	314.000000	314.000000	314.000000
	mean	27.915709	44.479818	2.159236	0.649682	431.028662	0.694268	0.742038
	std	14.110146	57.997698	0.857290	1.022846	256.846324	1.156520	0.438211
	min	0.750000	6.750000	1.000000	0.000000	2.000000	0.000000	0.000000
	25%	NaN	12.071875	1.000000	0.000000	231.750000	0.000000	0.000000
	50%	NaN	23.000000	2.000000	0.000000	414.500000	0.000000	1.000000
	75%	NaN	55.000000	3.000000	1.000000	641.250000	1.000000	1.000000
	max	63.000000	512.329200	3.000000	6.000000	889.000000	8.000000	1.000000
male	**count**	453.000000	577.000000	577.000000	577.000000	577.000000	577.000000	577.000000
	mean	30.726645	25.523893	2.389948	0.235702	454.147314	0.429809	0.188908
	std	14.678201	43.138263	0.813580	0.612294	257.486139	1.061811	0.391775
	min	0.420000	0.000000	1.000000	0.000000	1.000000	0.000000	0.000000
	25%	NaN	7.895800	2.000000	0.000000	222.000000	0.000000	0.000000
	50%	NaN	10.500000	3.000000	0.000000	464.000000	0.000000	0.000000
	75%	NaN	26.550000	3.000000	0.000000	680.000000	0.000000	0.000000
	max	80.000000	512.329200	3.000000	5.000000	891.000000	8.000000	1.000000

In [207]:
```
#Creating plot of number of male and female onboard of Titanic
titanic_class = sns.countplot(x="Sex", data=titanic_df)
titanic_class.set(xlabel='Sex', ylabel='Number of passengers', title = 'Titanic passangers count
 by sex')
```

Out[207]:
```
[<matplotlib.text.Text at 0x1c6aaeb8>,
 <matplotlib.text.Text at 0x18664780>,
 <matplotlib.text.Text at 0x1d2ed748>]
```



In [208]:
```
# group the passengers that survived by gender
passengers_by_sex = titanic_df.groupby("Sex")
# find total number of survived by gender
total = passengers_by_sex["Survived"].count()
```

In [209]:
```
print "There were ",total["female"], "females and", total["male"], "males onboard of Titanic shi
p."
```

```
There were  314 females and 577 males onboard of Titanic ship.
```

From the analysis of the sex data we can conclude that females had higher chance to survive Titanic catastrophe.

4.3 Exploring class data

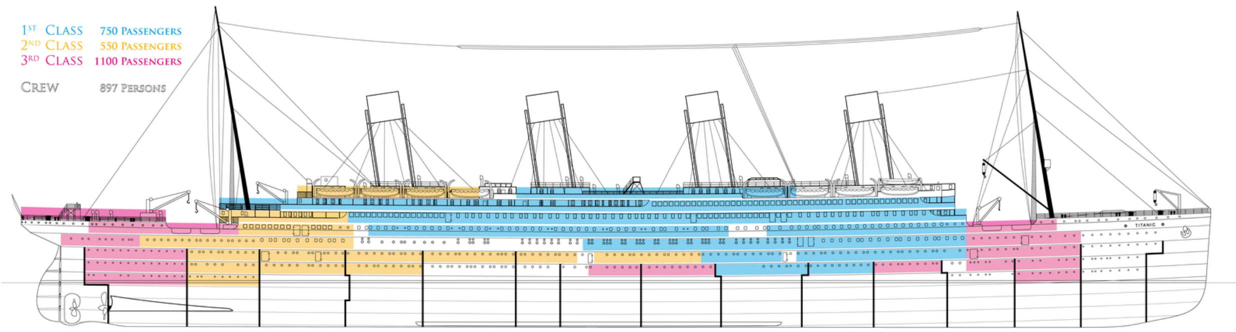
There were 3 classes of passangers on Titanic vessel. The Titanic's first class passenger list was a "who's who" of the rich and prominent of the upper class in 1912. Second classes passengers were leisure tourists, academics, members of the clergy and middle class English and American families. The third class passengers or steerage passengers left hoping to start new lives in the United States and Canada.

Image below shows location of each class on the vessel:

```
* 1st Class: blue
* 2nd Class: yellow
* 3rd class: red
```

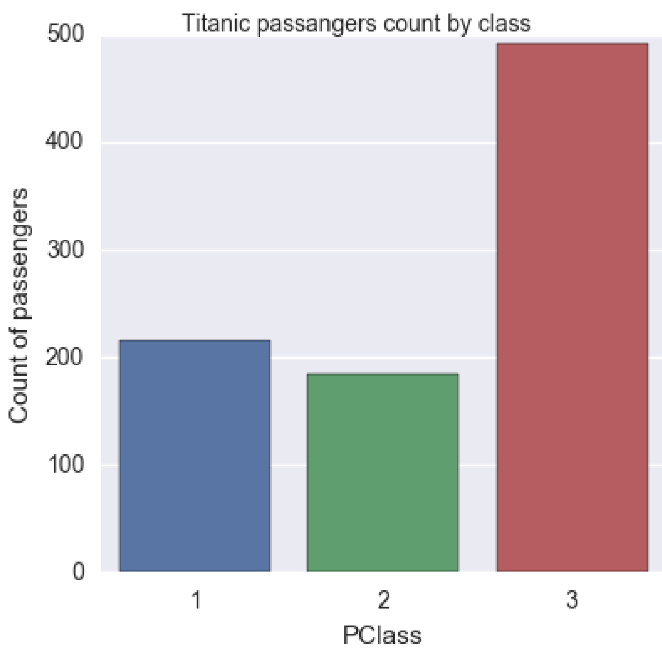
In [210]:
```
#Load image from url
Image(url= "http://img07.deviantart.net/af19/i/2014/307/c/f/r_m_s__titanic_class_system_by_monroegerman-d787jna.png", width=900, height=900, unconfined=True)
```

Out[210]:



In [211]:
```
#Create histogram showing passanger count by class
class_plot = sns.factorplot('PClass', order=[1,2,3], data=titanic_df, kind='count')
class_plot.despine(left=True)
class_plot.set_ylabels("Count of passengers")
class_plot.fig.suptitle('Titanic passangers count by class')
```

Out[211]: <matplotlib.text.Text at 0x1d573518>



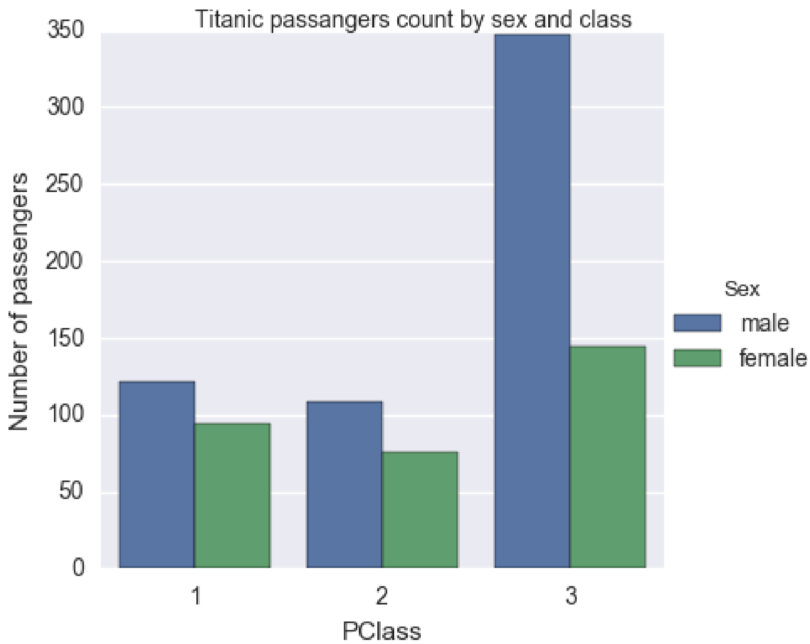
In [212]:
```
#Display passanger count by Class
titanic_df["PClass"].value_counts()
```

Out[212]:
```
3.0    491
1.0    216
2.0    184
Name: PClass, dtype: int64
```

We can observe that majority of passanger were 3rd class passangers.

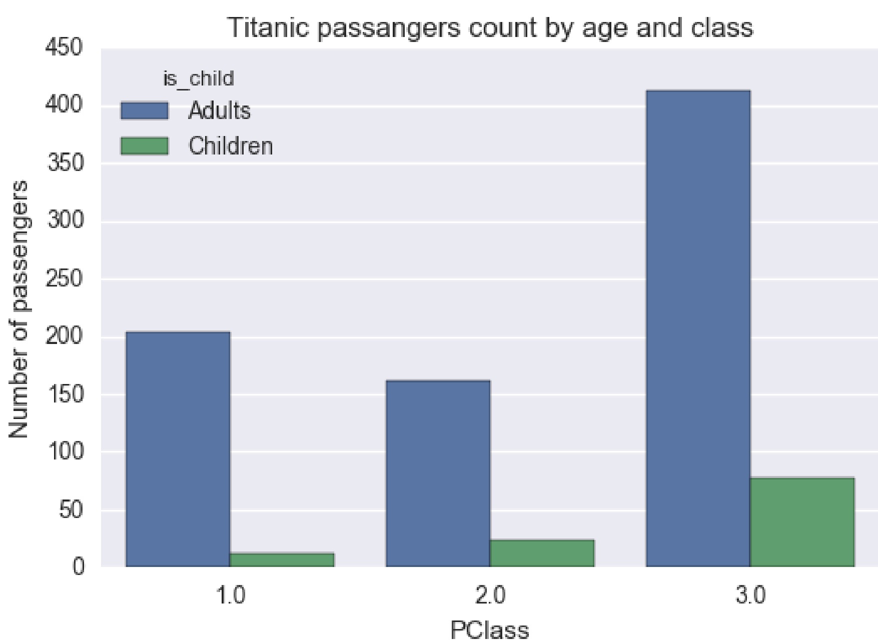
In [213]:
```
#Create histogram showing passanger count by class
class_plot = sns.factorplot('PClass', order=[1,2,3], hue = "Sex", data=titanic_df, kind='count')
class_plot.despine(left=True)
class_plot.set(xlabel='PClass', ylabel='Number of passengers')
class_plot.fig.suptitle('Titanic passangers count by sex and class')
```

Out[213]:
```
<matplotlib.text.Text at 0x1d5690b8>
```



In [214]:
```
#Create plot showing adults and children count per class
titanic_class = sns.countplot(x="PClass", hue="is_child", data=titanic_df)
titanic_class.set(xlabel='PClass', ylabel='Number of passengers', title = 'Titanic passangers co
unt by age and class')
```

Out[214]:
```
[<matplotlib.text.Text at 0x1d264400>,
 <matplotlib.text.Text at 0x1d73cdd8>,
 <matplotlib.text.Text at 0x1d9a5128>]
```



We can see that a lot more men were on the third class.

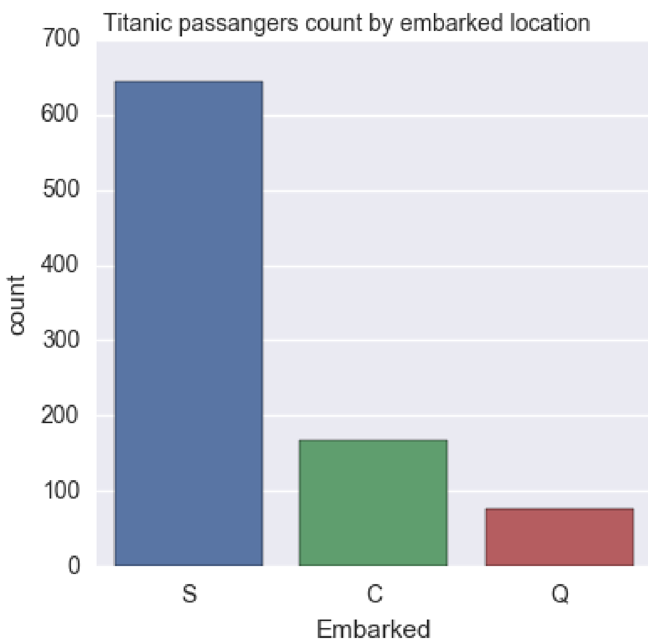
4.4 Exploring Embarked data

In [220]:
```
#Display passanger count by Embarked location
available_embarked_passengers["Embarked"].value_counts()
```

Out[220]:
```
S    644
C    168
Q     77
Name: Embarked, dtype: int64
```

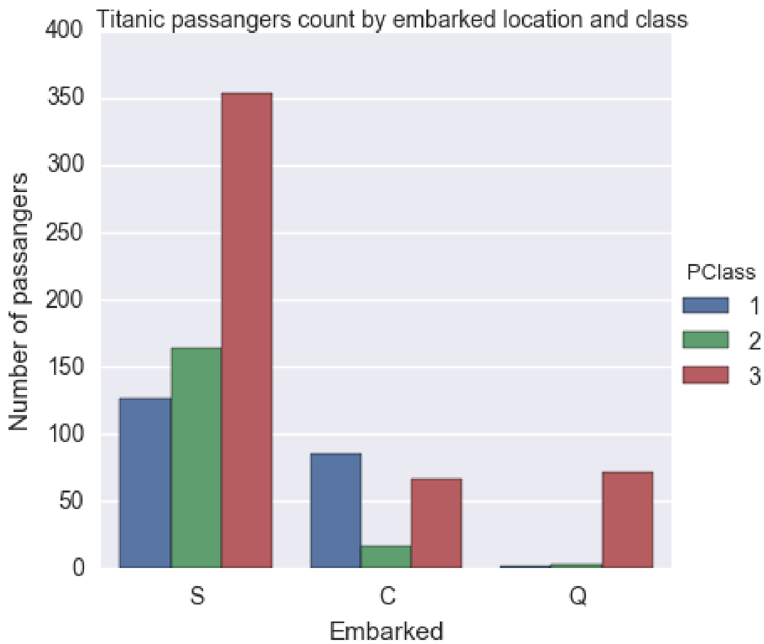
In [258]:
```
##Create histogam which shows number passangers by Embarked location
embarked_plot = sns.factorplot('Embarked', data = available_embarked_passengers, kind='count')
embarked_plot.despine(left=True)
embarked_plot.fig.suptitle('Titanic passangers count by embarked location', fontsize=10)
```

Out[258]: `<matplotlib.text.Text at 0x1f9e7a90>`



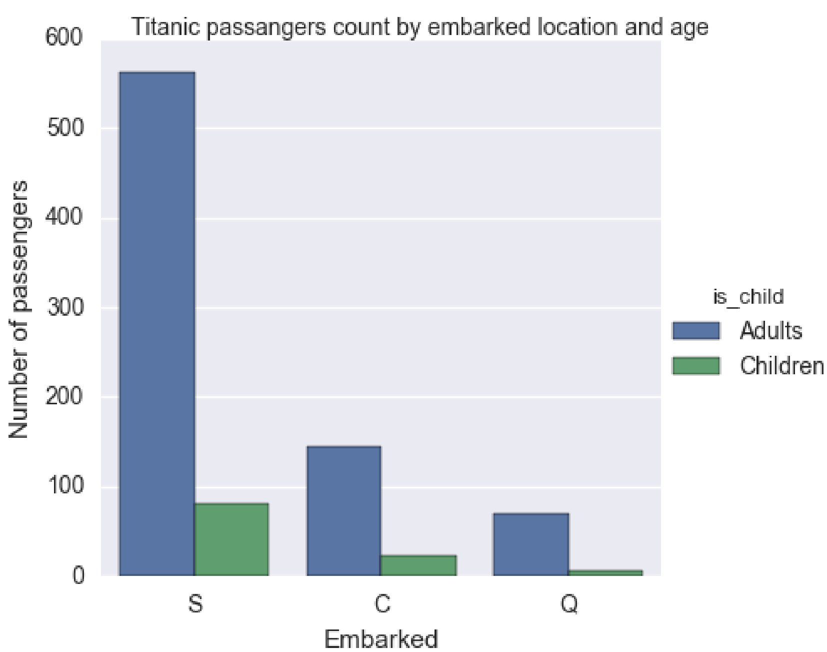
In [222]:
```
embarked_plot_class = sns.factorplot('Embarked', hue = "PClass", data=available_embarked_passeng
ers, kind='count')
embarked_plot_class.despine(left=True)
embarked_plot_class.set_ylabels("Number of passangers")
embarked_plot_class.fig.suptitle('Titanic passangers count by embarked location and class')
```

Out[222]: <matplotlib.text.Text at 0x18645da0>



In [225]:
```
embarked_plot_is_child = sns.factorplot('Embarked', hue = "is_child", data=titanic_df, kind='cou
nt')
embarked_plot_is_child.despine(left=True)
embarked_plot_is_child.set_ylabels("Number of passengers")
embarked_plot_is_child.fig.suptitle('Titanic passangers count by embarked location and age')
```

Out[225]: <matplotlib.text.Text at 0x1bef95f8>

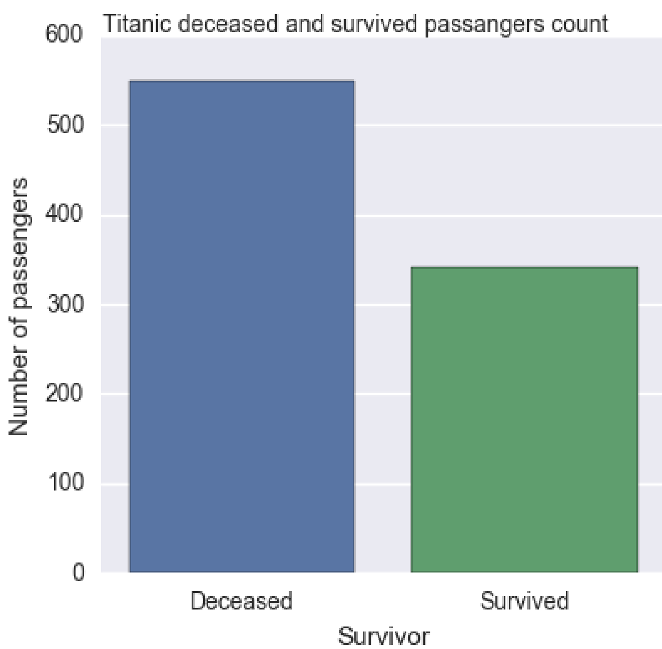


5. Survival estimation for passangers using Age, Gender, PClass, Embarked, Deck data

After performing analysis of the data and number of calculations, i will asses the groups and their survivalbility. Moreover, I will adressed the questions I asked in the introduction, and I answered them based on the data, I also made some visualizations to help understanding the given numbers.

In [224]:
```
# Create plot showing deceased and survived passangers
titanic_df['Survivor']= titanic_df.Survived.map({0:'Deceased', 1:'Survived'})

survivor_plot = sns.factorplot('Survivor', data=titanic_df, kind='count', palette="deep")
survivor_plot.despine(left=True)
survivor_plot.set_ylabels("Number of passengers")
survivor_plot.fig.suptitle('Titanic deceased and survived passangers count', fontsize=10)
```

Out[224]: <matplotlib.text.Text at 0x1bcec4e0>



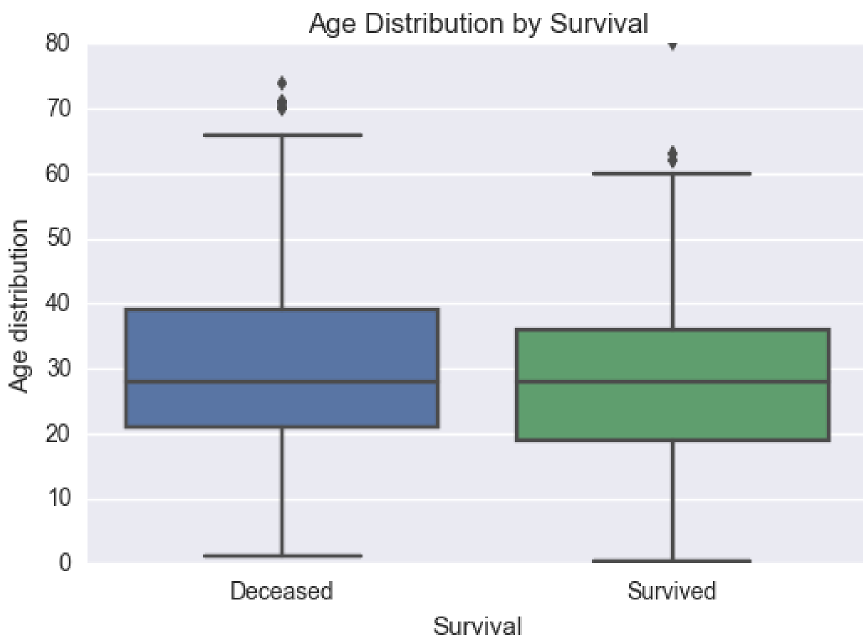
In [182]:
```
#Calculate number of survived and deceased passangers
titanic_df['Survivor'].value_counts()
```

Out[182]:
```
Deceased    549
Survived    342
Name: Survivor, dtype: int64
```

Q1: Is there a difference on survival rate between passangers in regards to the age?

In [226]:
```
#Create boxplot showing distribution of age vs survival
survival_age_plot = sns.boxplot(data=titanic_df, x='Survived', y='Age')
survival_age_plot.set(title='Age Distribution by Survival',
            xlabel = 'Survival',
            ylabel = 'Age distribution',
            xticklabels = ['Deceased', 'Survived'])
```

Out[226]:
```
[<matplotlib.text.Text at 0x1bee26a0>,
 [<matplotlib.text.Text at 0x1bcfe6a0>, <matplotlib.text.Text at 0x1c24e2b0>],
 <matplotlib.text.Text at 0x1bc1bac8>,
 <matplotlib.text.Text at 0x1c8a4748>]
```



In [52]:
```
#Display count of adults and children
titanic_df["is_child"].value_counts()
```

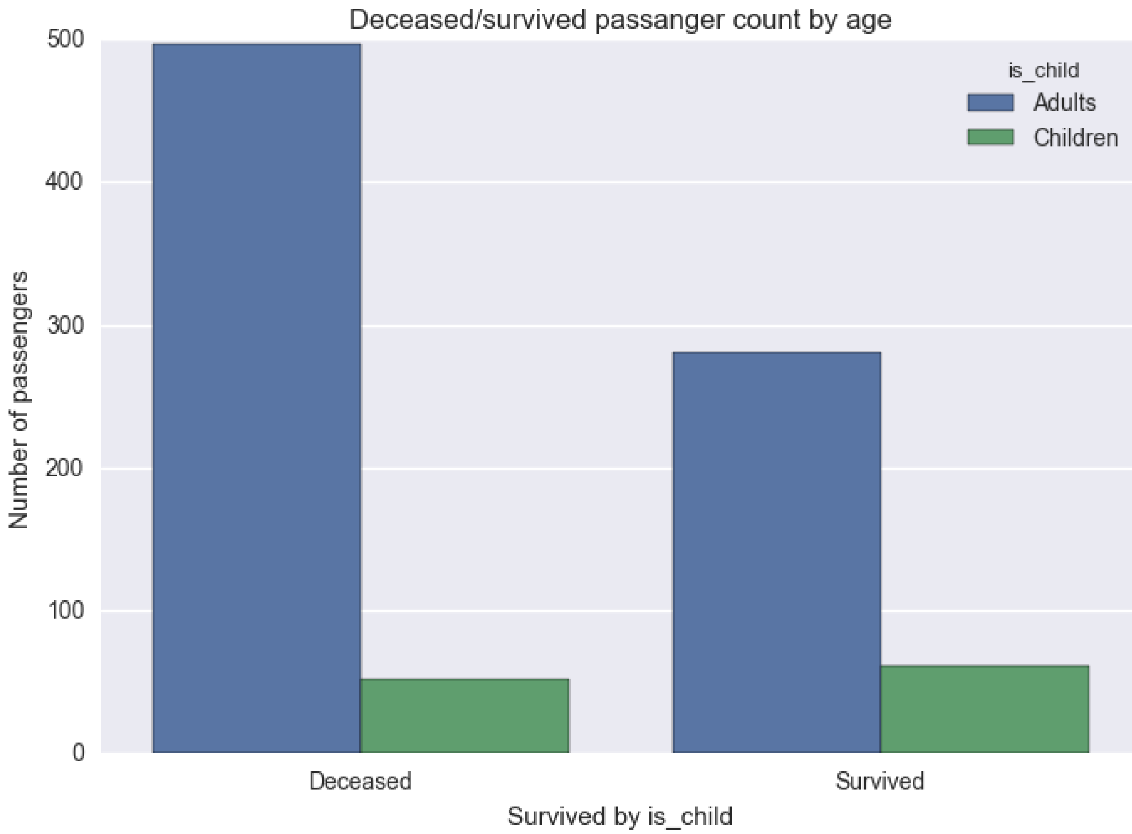
Out[52]:
```
Adults      778
Children    113
Name: is_child, dtype: int64
```

In [227]:
```
# group the passengers that survived by is_child
passengers_by_is_child = titanic_df.groupby("is_child")
# find total count
total = passengers_by_is_child["is_child"].count()
# find total count of survived
survived = passengers_by_is_child["Survived"].sum().astype(int)
# find total count of deceased
deceased = (total - survived).astype(int)
print "Survived by", survived
print " "
print "Deceased by", deceased
```

```
Survived by is_child
Adults      281
Children     61
Name: Survived, dtype: int32

Deceased by is_child
Adults      497
Children     52
dtype: int32
```

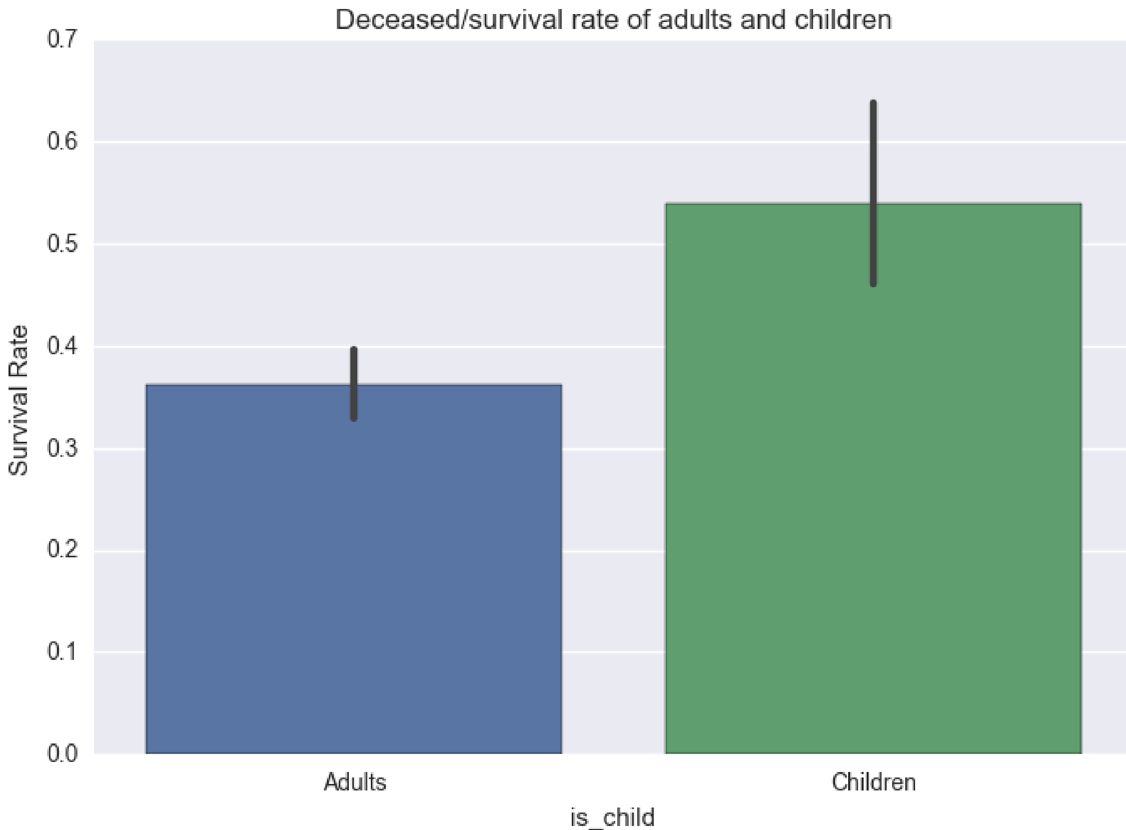
In [254]:
```
#Create histogram showing count of survived/deceased adults and children
survival_is_child_plot = sns.countplot(x="Survivor", hue="is_child", data=titanic_df)
survival_is_child_plot.set(xlabel='Survived by is_child', ylabel='Number of passengers', title =
 'Deceased/survived passanger count by age')
```

Out[254]:
```
[<matplotlib.text.Text at 0x21324208>,
 <matplotlib.text.Text at 0x20fa8710>,
 <matplotlib.text.Text at 0x214030b8>]
```



In [229]:
```
#Creating a bar plot of survived adults and children
survived_adults_children = sns.set(style="darkgrid")
survived_adults_children = sns.barplot(data=titanic_df, x="is_child", y="Survived", palette="dee
p",)
survived_adults_children.set(xlabel='is_child', ylabel='Survival Rate', title = 'Deceased/surviv
al rate of adults and children')
sns.plt.show
```

Out[229]: <function matplotlib.pyplot.show>



In [230]:
```
#Create correlation function between two parameters x and y
def correlation(x, y):
    std_x = (x - x.mean()) / x.std(ddof=0)
    std_y = (y - y.mean()) / y.std(ddof=0)

    return (std_x * std_y).mean()
```

In [231]:
```
age = titanic_df['Age']
survival = titanic_df['Survived']
# Using correlation function show correlation between two variables - age and survival
print "Pearsons R for age vs. survival: ", correlation(age, survival)
```

```
Pearsons R for age vs. survival:  -0.0779826784139
```

The boxplot is showing us that the mean of survived and deceased passangers is very close to each other. Calculation of Pearsons R for age vs. survival doesn't show that there is very clear corelation.

Q2: Is there a difference on survival rate between passangers in regards to the sex?

In [232]:

```
passengers_by_sex = titanic_df.groupby("Sex")
passengers_by_sex.describe()
```

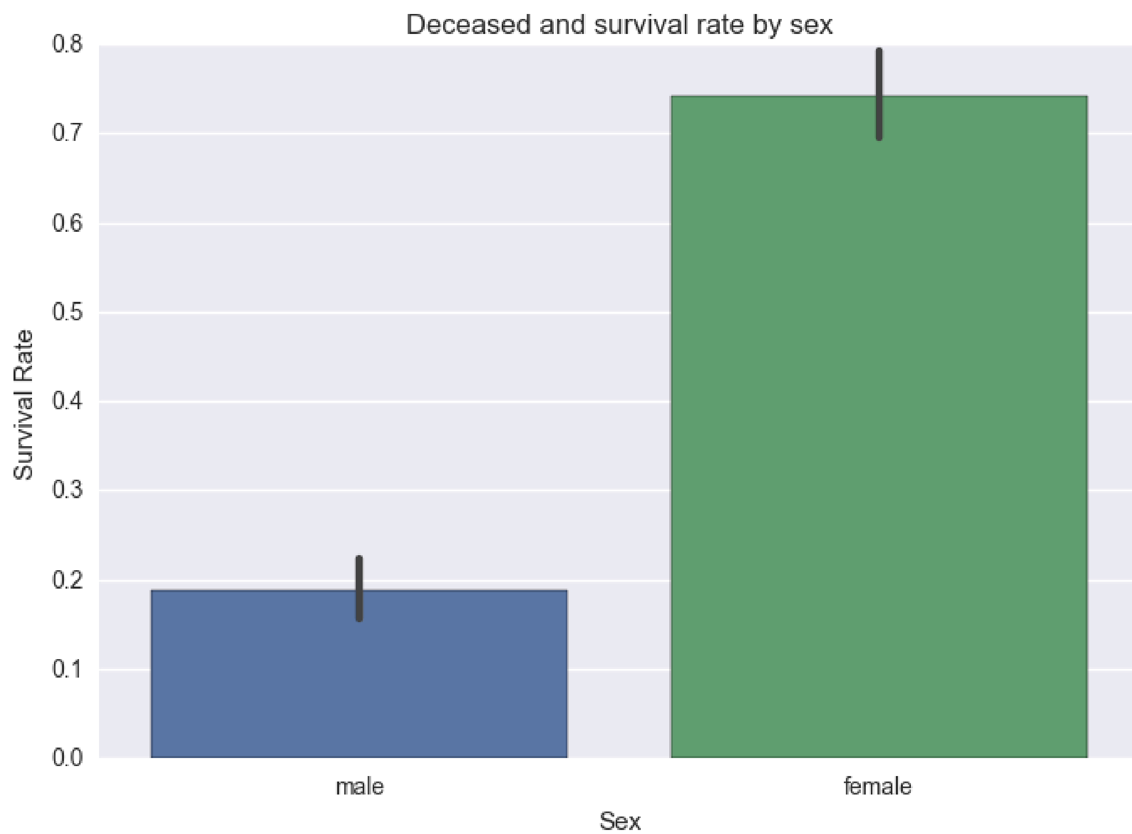
Age Fare PClass ParCh PassengerId SibSp Survived
Sex

Out[232]:

		Age	Fare	PClass	ParCh	PassengerId	SibSp	Survived
Sex								
female	**count**	261.000000	314.000000	314.000000	314.000000	314.000000	314.000000	314.000000
	mean	27.915709	44.479818	2.159236	0.649682	431.028662	0.694268	0.742038
	std	14.110146	57.997698	0.857290	1.022846	256.846324	1.156520	0.438211
	min	0.750000	6.750000	1.000000	0.000000	2.000000	0.000000	0.000000
	25%	NaN	12.071875	1.000000	0.000000	231.750000	0.000000	0.000000
	50%	NaN	23.000000	2.000000	0.000000	414.500000	0.000000	1.000000
	75%	NaN	55.000000	3.000000	1.000000	641.250000	1.000000	1.000000
	max	63.000000	512.329200	3.000000	6.000000	889.000000	8.000000	1.000000
male	**count**	453.000000	577.000000	577.000000	577.000000	577.000000	577.000000	577.000000
	mean	30.726645	25.523893	2.389948	0.235702	454.147314	0.429809	0.188908
	std	14.678201	43.138263	0.813580	0.612294	257.486139	1.061811	0.391775
	min	0.420000	0.000000	1.000000	0.000000	1.000000	0.000000	0.000000
	25%	NaN	7.895800	2.000000	0.000000	222.000000	0.000000	0.000000
	50%	NaN	10.500000	3.000000	0.000000	464.000000	0.000000	0.000000
	75%	NaN	26.550000	3.000000	0.000000	680.000000	0.000000	0.000000
	max	80.000000	512.329200	3.000000	5.000000	891.000000	8.000000	1.000000

In [253]:
```
#Creating a bar plot of survived males and females
survived_male_female = sns.set(style="darkgrid")
survived_male_female = sns.barplot(data=titanic_df, x="Sex", y="Survived", palette="deep")
survived_male_female.set(xlabel='Sex', ylabel='Survival Rate', title = 'Deceased and survival ra
te by sex')
plt.show
```

Out[253]:
```
<function matplotlib.pyplot.show>
```

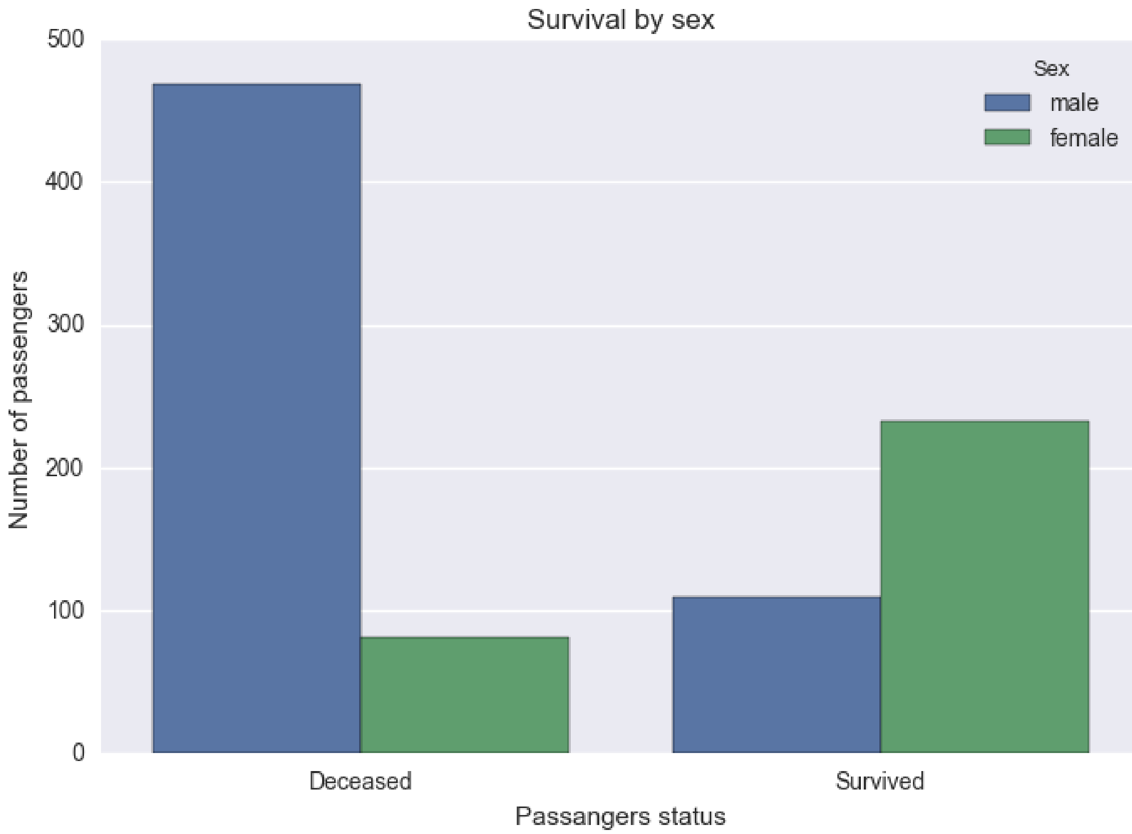


In [234]:
```
# Find number of survived by gender
survived = passengers_by_sex["Survived"].sum().astype(int)
# Find number of deceased by gender
deceased = (total - survived)
print "Survived by", survived
print " "
print "Deceased by", deceased
```

```
Survived by Sex
female    233
male      109
Name: Survived, dtype: int32

Deceased by Adults     NaN
Children   NaN
female     NaN
male       NaN
dtype: float64
```

In [252]:
```
#Creating a bar plot displaying number of survived/deceased males and females
survived = passengers_by_sex["Survived"]
survival.sex_plot = sns.countplot(x="Survivor", hue="Sex", data=titanic_df)
survival.sex_plot.set(xlabel='Passangers status', ylabel='Number of passengers', title = 'Surviv
al by sex')
```

Out[252]:
```
[<matplotlib.text.Text at 0x20dcf668>,
 <matplotlib.text.Text at 0x20dd5358>,
 <matplotlib.text.Text at 0x210791d0>]
```



In [236]:
```
survived = passengers_by_sex["Survived"].sum().astype(int)
# find total number of survived by gender
total = passengers_by_sex["Survived"].count()
```

In [237]:
```
percent_survived_females = (survived["female"] * 100) / total["female"]
print "Procent of survived females = ", percent_survived_females, "%"
print ""
#calculating % of survived males
percent_survived_males = (survived["male"] * 100) / total["male"]
print "Procent of survived males = ", percent_survived_males, "%"
```

```
Procent of survived females =  74 %

Procent of survived males =  18 %
```

From the analysis of the sex data we can conclude that females had much higher chance to survive Titanic catastrophe.

Q3: Is there a difference on survival rate between passangers located in different classes?

In [238]:

```
passengers_by_class = titanic_df.groupby("PClass")
passengers_by_class.describe()
```

Age Fare ParCh PassengerId SibSp Survived
PClass

Out[238]:

		Age	Fare	ParCh	PassengerId	SibSp	Survived
PClass							
1.0	**count**	186.000000	216.000000	216.000000	216.000000	216.000000	216.000000
	mean	38.233441	84.154687	0.356481	461.597222	0.416667	0.629630
	std	14.802856	78.380373	0.693997	246.737616	0.611898	0.484026
	min	0.920000	0.000000	0.000000	2.000000	0.000000	0.000000
	25%	NaN	30.923950	0.000000	270.750000	0.000000	0.000000
	50%	NaN	60.287500	0.000000	472.000000	0.000000	1.000000
	75%	NaN	93.500000	0.000000	670.500000	1.000000	1.000000
	max	80.000000	512.329200	4.000000	890.000000	3.000000	1.000000
2.0	**count**	173.000000	184.000000	184.000000	184.000000	184.000000	184.000000
	mean	29.877630	20.662183	0.380435	445.956522	0.402174	0.472826
	std	14.001077	13.417399	0.690963	250.852161	0.601633	0.500623
	min	0.670000	0.000000	0.000000	10.000000	0.000000	0.000000
	25%	NaN	13.000000	0.000000	234.500000	0.000000	0.000000
	50%	NaN	14.250000	0.000000	435.500000	0.000000	0.000000
	75%	NaN	26.000000	1.000000	668.000000	1.000000	1.000000
	max	70.000000	73.500000	3.000000	887.000000	3.000000	1.000000
3.0	**count**	355.000000	491.000000	491.000000	491.000000	491.000000	491.000000
	mean	25.140620	13.675550	0.393075	439.154786	0.615071	0.242363
	std	12.495398	11.778142	0.888861	264.441453	1.374883	0.428949
	min	0.420000	0.000000	0.000000	1.000000	0.000000	0.000000
	25%	NaN	7.750000	0.000000	200.000000	0.000000	0.000000
	50%	NaN	8.050000	0.000000	432.000000	0.000000	0.000000
	75%	NaN	15.500000	0.000000	666.500000	1.000000	0.000000
	max	74.000000	69.550000	6.000000	891.000000	8.000000	1.000000

In [239]:

```
# group the passengers that survived by class
passengers_by_class = titanic_df.groupby("PClass")
total = passengers_by_class["PClass"].count()
```

In [240]:

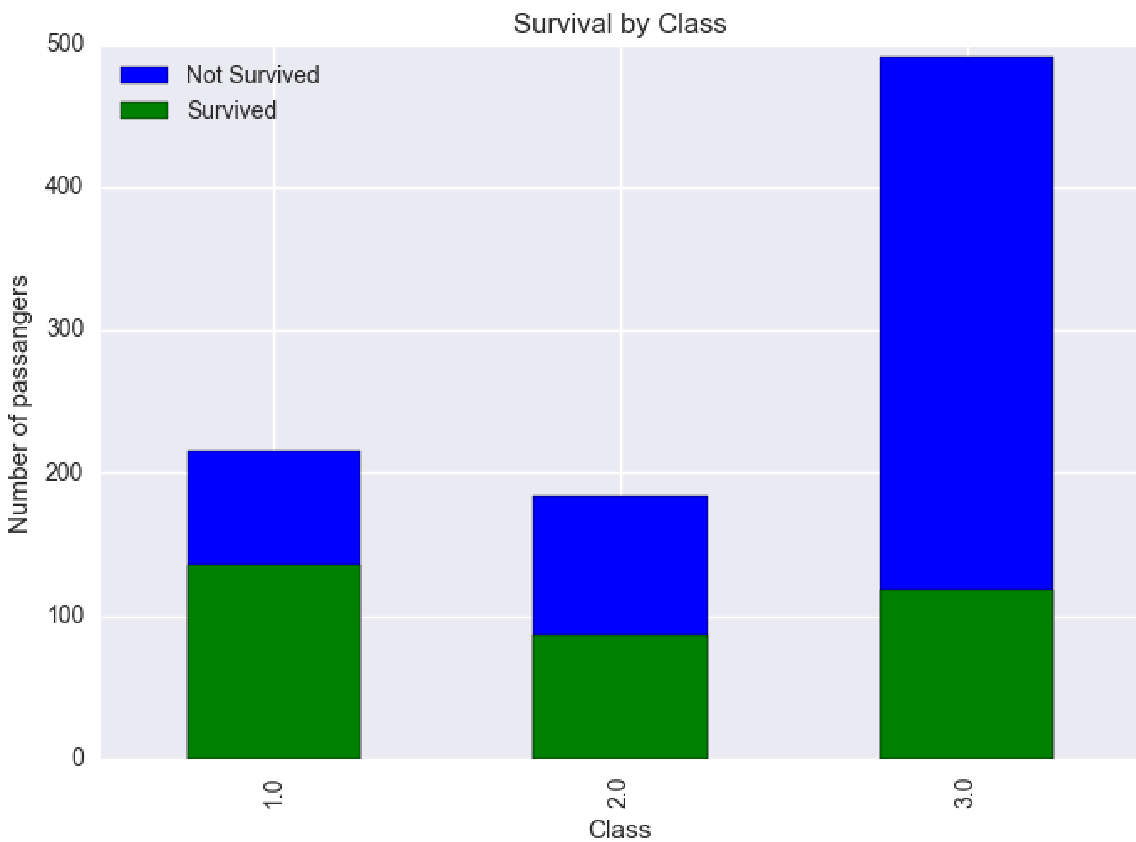
```
#Total count of passangers in PClass
print total
print""
#Count of survived passangers embarked in different classes
survived = passengers_by_class["Survived"].sum().astype(int)
print ""
deceased = (total - survived).astype(int)
print "Survived by", survived,
print ""
print "Deceased by", deceased,
```

```
PClass
1.0    216
2.0    184
3.0    491
Name: PClass, dtype: int64


Survived by PClass
1.0    136
2.0     87
3.0    119
Name: Survived, dtype: int32
Deceased by PClass
1.0     80
2.0     97
3.0    372
dtype: int32
```

As we can see survived rate differs quite a lot between different classes. The first class passengers had the highest survival rate (63%), followed by the 2nd class (47%) and the 3rd class (24%).

In [241]:
```
#Create plot which shows survived and deceased passanger count per class
survival.class_plot_total = passengers_by_class["Survived"].count()
survived = passengers_by_class["Survived"].sum()
survival.class_plot_total.plot(kind="bar", color="b", label="Not Survived")
survived.plot(kind="bar", color="g", label="Survived")
plt.xlabel('Class')
plt.ylabel('Number of passangers')
plt.title('Survival by Class')
plt.legend(loc=2)
```

Out[241]:
```
<matplotlib.legend.Legend at 0xed87748>
```

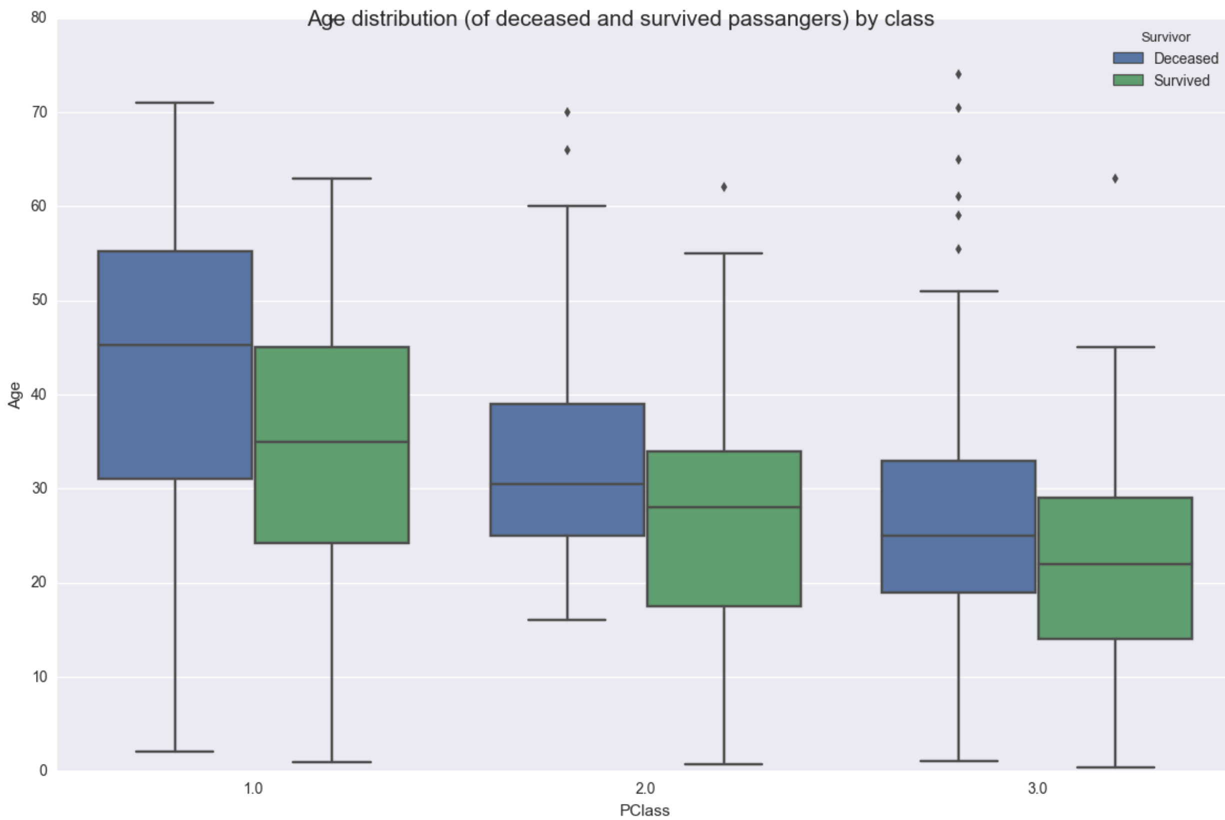


As we can remember from the exploration part there were more men than female in the third class, which in the end limited the chances of survival of the passangers in the third class.

Below boxplots represent Age distribution per class of survived Titanic passangers.

In [246]:
```
#create boxplot of age distribution in classes 1,2,3 vs, survived and deceased


boxplot = sns.factorplot(kind='box',        # Boxplot
               y='Age',           # Y-axis - values for boxplot
               x='PClass',        # X-axis - first factor
               hue='Survivor',    # Second factor denoted by color
               data=titanic_df,       # Dataframe
               size=8,            # Figure size (x100px)
               aspect=1.5,        # Width = size * aspect
               legend_out=False)
boxplot.fig.suptitle('Age distribution (of deceased and survived passangers) by class', fontsize=
)
```

Out[246]: <matplotlib.text.Text at 0x209065f8>



Third-class and crew cabins were located in the hold, while promenade areas were on lower decks and in the quarter. They were separated from the promenade decks for wealthier passengers by special partitions – staircases leading to upper decks had metal gates, the keys to which were kept by stewards. Some sources claim that these partitions were required by American immigration laws at the time.The majority of passengers on the Titanic were emigrants. Only 25 percent of the Titanic's third-class passengers survived, with small percentage of male. On the other hand we can observe high survival rate in the passangers in the first class. It also has to be taken into the account that there were quite big precent of woman in the first class.

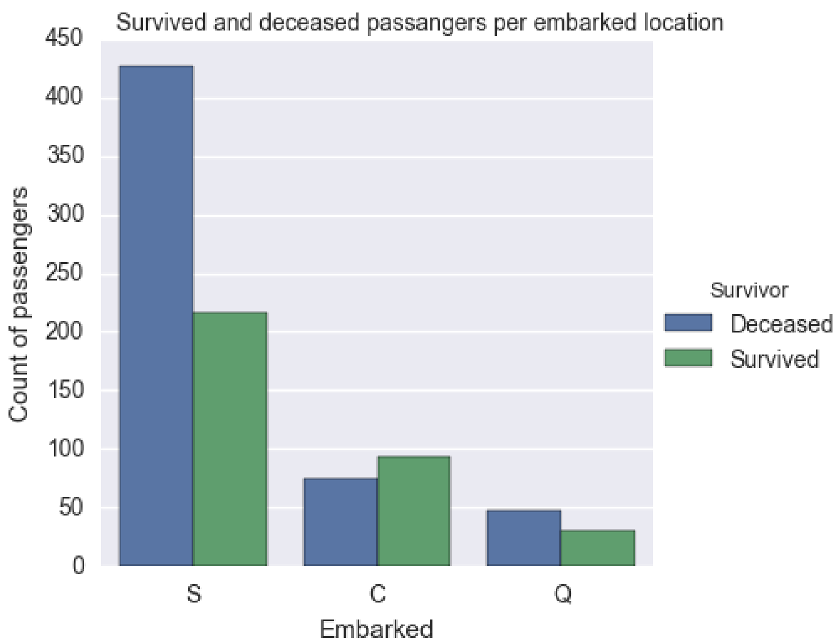
We can also observe from above displayed boxplots that younger people had slighty better chance to survive in classes 1,2,3.

Third class was the group hardest hit by the disaster and experiencing the greatest loss of life. According to many sources the reasons for could be: first and second class given more importance, many did not understand the true magnitude of the disaster right after the collision with the Titanic, at least some of the third class gates remained locked, and many of the passengers that were non-English speaking did not understand.

Q4: Is there a difference on survival rate between location of the embarkment of the passangers?

In [247]:
```
#Create plot which shows deceased and survived passangers count per embarked location
survival.embarked_plot = sns.factorplot('Embarked', hue = "Survivor", data=titanic_df, kind='cou
nt')
survival.embarked_plot.despine(left=True)
survival.embarked_plot.set_ylabels("Count of passengers")
survival.embarked_plot.fig.suptitle('Survived and deceased passangers per embarked location', fo
ntsize=10)
```

Out[247]: <matplotlib.text.Text at 0x20fc07b8>



Note: C = Cherbourg; Q = Queenstown; S = Southampton

In [248]:
```
# group the passengers that survived by gender
passengers_by_embarked = titanic_df.groupby("Embarked")
# find the values and labels for the area circles
total = passengers_by_embarked["Embarked"].count()

#Total count of passangers embarked in Cherbourg, Queenstown, Southampton
print total
print""
#Count of survived passangers embarked in Cherbourg, Queenstown, Southampton
survived = passengers_by_embarked["Survived"].sum().astype(int)
print ""
deceased = (total - survived).astype(int)
print "Survived by", survived,
print ""
#Count of deceased passangers embarked in Cherbourg, Queenstown, Southampton
print ""
print "Deceased by", deceased,
```

```
Embarked
C    168
Q     77
S    644
Name: Embarked, dtype: int64


Survived by Embarked
C     93
Q     30
S    217
Name: Survived, dtype: int32

Deceased by Embarked
C     75
Q     47
S    427
dtype: int32
```

In [249]:
```
#calculating % of survived by embarked location
percent_survived_embarked = (survived["C"] * 100) / total["C"]
print "Procent of survived passangers embarked in Cherbourg = ", percent_survived_embarked, "%"
print ""
percent_survived_embarked = (survived["Q"] * 100) / total["Q"]
print "Procent of survived passangers embarked in Queenstown  = ", percent_survived_embarked,
"%"
print ""
percent_survived_embarked = (survived["S"] * 100) / total["S"]
print "Procent of survived passangers embarked in Southampton = ", percent_survived_embarked,
"%"
```

```
Procent of survived passangers embarked in Cherbourg =  55 %

Procent of survived passangers embarked in Queenstown  =  38 %

Procent of survived passangers embarked in Southampton =  33 %
```

Q5: Is there a difference on survival rate between passangers located on different decks?

In [250]:
```
#known_cabin_passengers["Deck"].descibe()

# group the passengers that survived by gender
passengers_by_deck = known_cabin_passengers.groupby("Deck")
# find the values and labels for the area circles
total = passengers_by_deck["Deck"].count()

#Total count of passangers embarked in Cherbourg, Queenstown, Southampton
print total
print""
#Count of survived passangers embarked in Cherbourg, Queenstown, Southampton
survived = passengers_by_deck["Survived"].sum().astype(int)
print ""
deceased = (total - survived).astype(int)
print "Survived by", survived,
print ""
#Count of deceased passangers embarked in Cherbourg, Queenstown, Southampton
print ""
print "Deceased by", deceased,
```

```
Deck
A    15
B    64
C    71
D    34
E    33
F    13
G     7
T     1
Name: Deck, dtype: int64


Survived by Deck
A     7
B    48
C    41
D    26
E    25
F     8
G     2
T     0
Name: Survived, dtype: int32

Deceased by Deck
A     8
B    16
C    30
D     8
E     8
F     5
G     5
T     1
dtype: int32
```

In [251]:
```
#calculating % of survived by embarked location

percent_survived_deckA = (survived["A"] * 100) / total["A"]
print "Procent of survived passangers on deck A = ", percent_survived_deckA, "%"
print ""
percent_survived_deckB = (survived["B"] * 100) / total["B"]
print "Procent of survived passangers on deck B = ", percent_survived_deckB, "%"
print ""
percent_survived_deckC = (survived["C"] * 100) / total["C"]
print "Procent of survived passangers on deck C = ", percent_survived_deckC, "%"
print ""
percent_survived_deckD = (survived["D"] * 100) / total["D"]
print "Procent of survived passangers on deck C = ", percent_survived_deckD, "%"
print ""
percent_survived_deckD = (survived["D"] * 100) / total["D"]
print "Procent of survived passangers on deck D = ", percent_survived_deckD, "%"
print ""
percent_survived_deckE = (survived["E"] * 100) / total["E"]
print "Procent of survived passangers on deck E = ", percent_survived_deckE, "%"
print ""
percent_survived_deckF = (survived["F"] * 100) / total["F"]
print "Procent of survived passangers on deck F = ", percent_survived_deckF, "%"

#No caluclation for Deck T as only 1 passanger present on that deck
```

```
Procent of survived passangers on deck A =  46 %

Procent of survived passangers on deck B =  75 %

Procent of survived passangers on deck C =  57 %

Procent of survived passangers on deck C =  76 %

Procent of survived passangers on deck D =  76 %

Procent of survived passangers on deck E =  75 %

Procent of survived passangers on deck F =  61 %
```

From above done analysis we can see that the least chance of survival had passngers located on deck A.

Conclusions

While using the Titanic dataset I found several limitations that made making deeper analysis more difficult and in some cases unreliable. The limitation i had to face are following:

1. Big number of data was missing. We had available data of only 891 passangers from 2224 that were present on titanic. This represents only 40% of the total passangers.
2. From 891 passangers so much as 708 passangers had at least one type of data missing (e.g age). This mean 79% of data is missing in the provided dataset. This is quite a big number and represents
3. Assesing age and cabin data turned out to be challenging as 177 and 687 data points were missing respectively in those columns.
4. There might be other factors that have impacted the chances of survival. It was reported in multiple articles that gates separating 3rd class were mostly closed and thus they could not escape so easily to the lifeboats.
5. Deck data might be not correct due to the fact that it's impossible to say where the passangers were at the time of the catastrophe. The same would apply to cabin data which i did not analyzed.

Main conclusions:

1. The number of surviving females (74%) exceeded the number of surviving males (18%) aboard RMS Titanic.
2. The number of children survived in the disaster significantly exceeded the number of survived adults.
3. Passsengers with age between 20 and 35 tended to survive the most. This is caused by the fact that the number of passanger in this age group was higher so i can not say that there is an actual correlation between age and survival rate.
4. Passangers in the first class had higher chance of survival than from class two and three. Survival precent of passangers in classes were folowing: 1st: 63%, 2nd Class 47%, 3rd Class 24%.
5. Passangers embarked in Cherbourg had higher chances of survival than passangers embarked in Queenstown or Southampton.
6. Passangers located on Deck A had the lowest chances of survival.

I think there is still a room for further analysis which due to the time constraint i did not manage to perform. Those would be folowing:

1. Asses if the people traveling with family(wife, husband, children) had higher chance to survive.
2. Asses if the size of family had a influence on chance of survival.
3. Asses distribution of the lifeboats on the titanic in comparision of survival on different decks/cabins.
4. Performing statistical testing to validating results in order to strengten validation of the correlational observations.

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