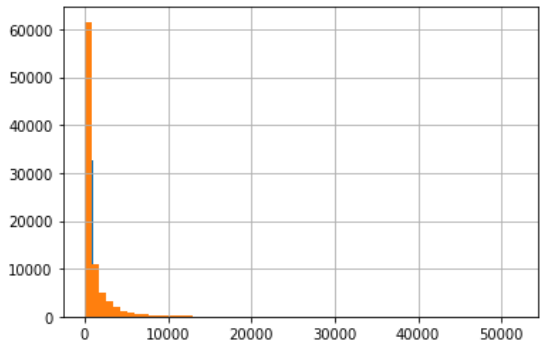
In [6]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

def entries_histogram(turnstile_weather):
    '''
    Before we perform any analysis, it might be useful to take a
    look at the data we're hoping to analyze. More specifically, let's
    examine the hourly entries in our NYC subway data and determine what
    distribution the data follows. This data is stored in a dataframe
    called turnstile_weather under the ['ENTRIESn_hourly'] column.

    Let's plot two histograms on the same axes to show hourly
    entries when raining vs. when not raining. Here's an example on how
    to plot histograms with pandas and matplotlib:
    turnstile_weather['column_to_graph'].hist()

    Your histogram may look similar to bar graph in the instructor notes below.

    You can read a bit about using matplotlib and pandas to plot histograms here:
    http://pandas.pydata.org/pandas-docs/stable/visualization.html#histograms

    You can see the information contained within the turnstile weather data here:
    https://s3.amazonaws.com/content.udacity-data.com/courses/ud359/turnstile_data_master_with_weather.csv
    '''
    turnstile_weather=pd.read_csv(turnstile_weather)
    x = turnstile_weather["ENTRIESn_hourly"][turnstile_weather["rain"] == 1] # your code here to plot a historgram for hourly ent
    y = turnstile_weather["ENTRIESn_hourly"][turnstile_weather["rain"] == 0] # your code here to plot a historgram for hourly ent
    plt.figure()
    x.hist(bins=50)
    y.hist(bins=50)
    return plt

if __name__ == "__main__":
    filename = 'turnstile_data_master_with_weather.csv'
    output=entries_histogram(filename)
    print(output)
```

```
<module 'matplotlib.pyplot' from 'C:\\Users\\muham\\.conda\\envs\\DataScience\\lib\\site-packages\\matplotlib\\pypl
ot.py'>
```



In [9]:

```
import numpy as np
import scipy
import scipy.stats
import pandas

def mann_whitney_plus_means(turnstile_weather):
    '''
    This function will consume the turnstile_weather dataframe containing
    our final turnstile weather data.

    You will want to take the means and run the Mann Whitney U-test on the
    ENTRIESn_hourly column in the turnstile_weather dataframe.

    This function should return:
        1) the mean of entries with rain
        2) the mean of entries without rain
        3) the Mann-Whitney U-statistic and p-value comparing the number of entries
           with rain and the number of entries without rain

    You should feel free to use scipy's Mann-Whitney implementation, and you
    might also find it useful to use numpy's mean function.

    Here are the functions' documentation:
    http://docs.scipy.org/doc/scipy/reference/generated/scipy.stats.mannwhitneyu.html
    http://docs.scipy.org/doc/numpy/reference/generated/numpy.mean.html

    You can look at the final turnstile weather data at the link below:
    https://s3.amazonaws.com/content.udacity-data.com/courses/ud359/turnstile_data_master_with_weather.csv
    '''
    turnstile_weather=pandas.read_csv(turnstile_weather)
    rainy = turnstile_weather[turnstile_weather['rain'] == 1]
    with_rain_mean = np.mean(rainy['ENTRIESn_hourly'])
    not_rainy = turnstile_weather[turnstile_weather['rain'] == 0]
    without_rain_mean = np.mean(not_rainy['ENTRIESn_hourly'])
    U , p = scipy.stats.mannwhitneyu(rainy['ENTRIESn_hourly'], not_rainy['ENTRIESn_hourly'])
    return with_rain_mean, without_rain_mean, U, p # leave this line for the grader


if __name__ == "__main__":
    filename = 'turnstile_data_master_with_weather.csv'
    output=mann_whitney_plus_means(filename)
    print(output)
```

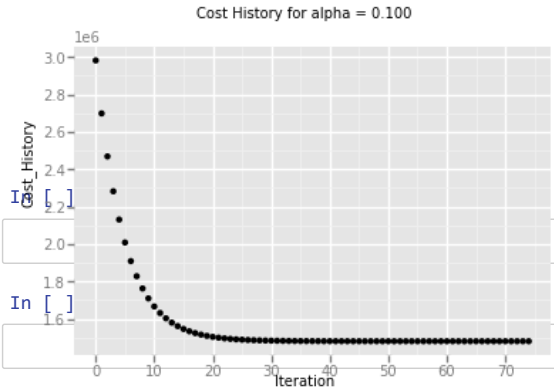
```
(1105.4463767458733, 1090.278780151855, 1949994921.0, 0.04988078458898675)
```

In [3]:

```
import numpy as np
import pandas
from ggplot import *
import sklearn

"""
In this question, you need to:
1) implement the compute_cost() and gradient_descent() procedures
2) Select features (in the predictions procedure) and make predictions.

"""

def normalize_features(df):
    """
    Normalize the features in the data set.
    """
    mu = df.mean()
    sigma = df.std()

    if (sigma == 0).any():
        raise Exception("One or more features had the same value for all samples, and thus could " + \
                        "not be normalized. Please do not include features with only a single value " + \
                        "in your model.")
    df_normalized = (df - df.mean()) / df.std()

    return df_normalized, mu, sigma

def compute_cost(features, values, theta):
    """
    Compute the cost function given a set of features / values,
    and the values for our thetas.

    This can be the same code as the compute_cost function in the lesson #3 exercises,
    but feel free to implement your own.
    """
    m = len(values)
    sum_of_square_errors = np.square(np.dot(features, theta) - values).sum()
    cost = sum_of_square_errors / (2*m)


    return cost

def gradient_descent(features, values, theta, alpha, num_iterations):
    """
    Perform gradient descent given a data set with an arbitrary number of features.

    This can be the same gradient descent code as in the lesson #3 exercises,
    but feel free to implement your own.
    """

    m = len(values)
    cost_history = []

    for i in range(num_iterations):
        predicted_values = np.dot(features, theta)
        theta -= (alpha / m) * np.dot((predicted_values - values), features)
        cost_history.append(compute_cost(features, values, theta))
    return theta, pandas.Series(cost_history)

def predictions(dataframe):
    '''
    The NYC turnstile data is stored in a pandas dataframe called weather_turnstile.
    Using the information stored in the dataframe, let's predict the ridership of
    the NYC subway using linear regression with gradient descent.

    You can download the complete turnstile weather dataframe here:
    https://www.dropbox.com/s/meyki2wl9xfa7yk/turnstile_data_master_with_weather.csv

    Your prediction should have a R^2 value of 0.40 or better.
    You need to experiment using various input features contained in the dataframe.
    We recommend that you don't use the EXITSn_hourly feature as an input to the
    linear model because we cannot use it as a predictor: we cannot use exits
    counts as a way to predict entry counts.

    Note: Due to the memory and CPU limitation of our Amazon EC2 instance, we will
    give you a random subet (~15%) of the data contained in
    turnstile_data_master_with_weather.csv. You are encouraged to experiment with
    this computer on your own computer, locally.


    If you'd like to view a plot of your cost history, uncomment the call to
    plot_cost_history below. The slowdown from plotting is significant, so if you
    are timing out, the first thing to do is to comment out the plot command again.
```

```
    If you receive a "server has encountered an error" message, that means you are
    hitting the 30-second limit that's placed on running your program. Try using a
    smaller number for num_iterations if that's the case.

    If you are using your own algorithm/models, see if you can optimize your code so
    that it runs faster.
    '''
    # Select Features (try different features!)
    features = dataframe[['rain', 'precipi', 'Hour', 'meantempi']]
    features_names=features.columns

    # Add UNIT to features using dummy variables
    dummy_units = pandas.get_dummies(dataframe['UNIT'], prefix='unit')
    features = features.join(dummy_units)

    # Values
    values = dataframe['ENTRIESn_hourly']
    m = len(values)

    features, mu, sigma = normalize_features(features)
    features['ones'] = np.ones(m) # Add a column of 1s (y intercept)

    # Convert features and values to numpy arrays
    features_array = np.array(features)
    values_array = np.array(values)

    # Set values for alpha, number of iterations.
    alpha = 0.1 # please feel free to change this value
    num_iterations = 75 # please feel free to change this value

    # Initialize theta, perform gradient descent
    theta_gradient_descent = np.zeros(len(features.columns))
    theta_gradient_descent, cost_history = gradient_descent(features_array,
                                                            values_array,
                                                            theta_gradient_descent,
                                                            alpha,
                                                            num_iterations)

    plot = None
    # -----------------------------------------------
    # Uncomment the next line to see your cost history
    # -----------------------------------------------
    #
    plot = plot_cost_history(alpha, cost_history)
    #
    # Please note, there is a possibility that plotting
    # this in addition to your calculation will exceed
    # the 30 second limit on the compute servers.

    predictions = np.dot(features_array, theta_gradient_descent)
    print(pd.Series(data=theta_gradient_descent[:len(features_names)], index=features_names))
#     print ('\n', 'R^2 = ', sklearn.metrics.r2_score(values_array, predictions))
    return predictions, plot

def plot_cost_history(alpha, cost_history):


    cost_df = pd.DataFrame({'Cost_History': cost_history,'Iteration': range(len(cost_history))})


    return ggplot(cost_df, aes('Iteration', 'Cost_History')) + geom_point() + ggtitle('Cost History for alpha = %.3f' % alpha )

if __name__ == "__main__":
    filename = 'turnstile_data_master_with_weather.csv'
    df=pandas.read_csv(filename)
    output=predictions(df)
    print(output)
```

```
rain          -9.099280
precipi       18.320000
Hour         464.123414
meantempi    -47.773255
dtype: float64
```



In [ ]

In [ ]

```
(array([3379.34466358, 3648.71075058, 3918.07683757, ...,  856.38536737,
        856.38536737,  856.38536737]), <ggplot: (-9223371924425513492)>)
```