Assigment 3

This assigment focuses on getting comfortable with working with multidimensional data and linear regression. Key items include:

- Creating random n-dimensional data
- Creating a Model that can handle the data
- Plot a subset of the data along with the prediction
- Using a Dataset to read in and choose certain columns to produce a model
- Create several models from various combinations of columns
- Plot a few of the results
- BONUS: Perform all the plots in 3D instead of 2D

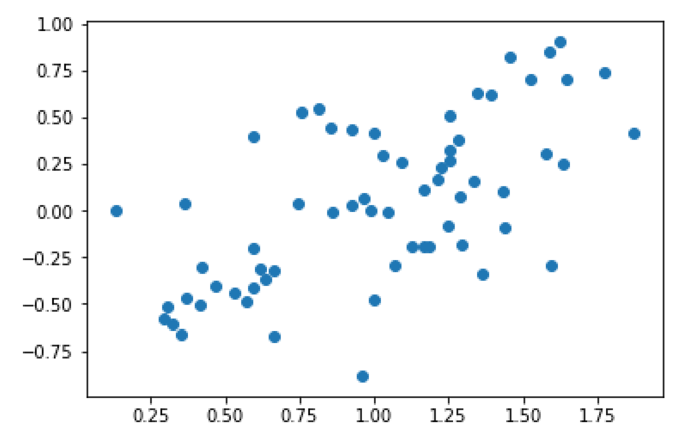
In [4]:
```
import numpy as np
import matplotlib.pylab as plt
%matplotlib inline
```

1. Create a 4 dimensional data set with 64 elements and show 2D plots of the data $x_1 \rightarrow y, x_2 \rightarrow y$, etc.

In [8]:
```
#make the dataset
n = 64
x = np.linspace(0, 1, n) + np.random.rand(4,n)
x = np.vstack([x, np.ones(len(x.T))]).T
y = np.linspace(0, 1, n) + np.random.rand(n) - 1
```

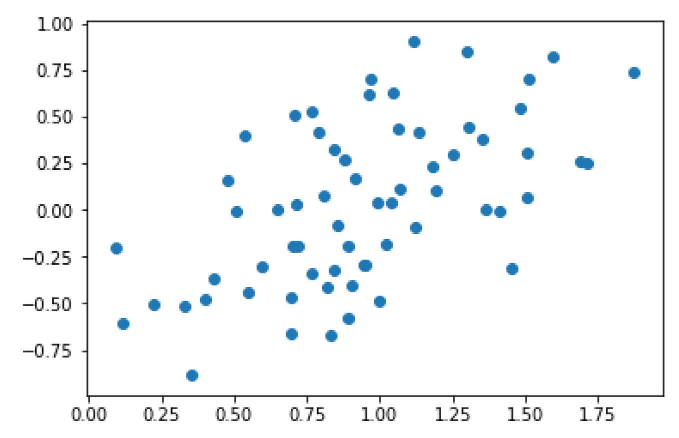
In [9]:
```
#plot y,x1
plt.scatter(x.T[0],y)
```

Out[9]:
```
<matplotlib.collections.PathCollection at 0x2a967d95668>
```



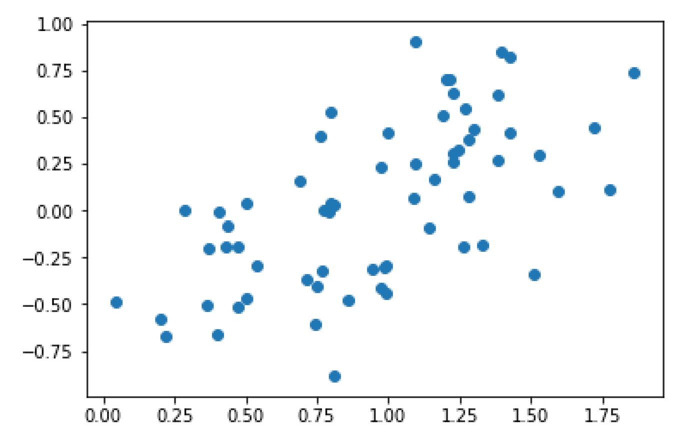
In [10]:
```
#plot y,x2
plt.scatter(x.T[1],y)
```

Out[10]:
```
<matplotlib.collections.PathCollection at 0x2a967e20ba8>
```



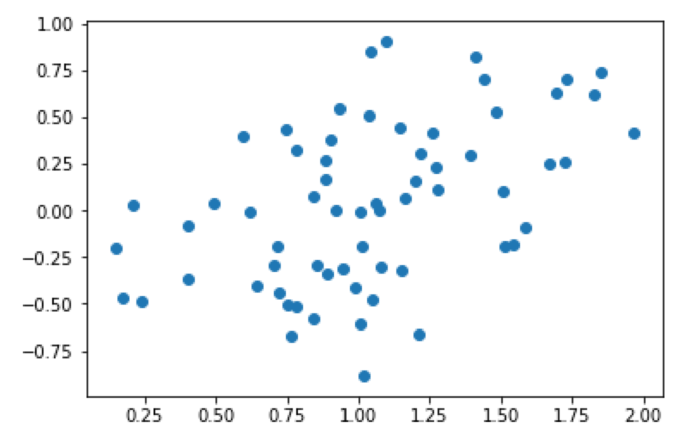
In [11]:
```
#plot y,x3
plt.scatter(x.T[2],y)
```

Out[11]:
```
<matplotlib.collections.PathCollection at 0x2a96809d7b8>
```



In [15]:
```
#plot y,x4
plt.scatter(x.T[3],y)
```

Out[15]:
```
<matplotlib.collections.PathCollection at 0x2a9681ca470>
```



2. Create a model to fit the data. Hint: follow the example from Lesson 3

In [16]:
```
left = np.linalg.inv(np.dot(x.T,x))
```

In [18]:
```
right = np.dot(y.T, x)
```

In [19]:
```
np.dot(left, right)
```

Out[19]:
```
array([ 3.20241053e-01,  2.75656281e-01,  2.85218671e-01, -8.06996665e-04,
       -8.20575701e-01])
```

In [20]:
```
beta = np.linalg.lstsq(x, y)[0]
beta
```

```
D:\Python\lib\site-packages\ipykernel_launcher.py:1: FutureWarning: `rcond` parameter will chang
e to the default of machine precision times ``max(M, N)`` where M and N are the input matrix dim
ensions.
To use the future default and silence this warning we advise to pass `rcond=None`, to keep using
the old, explicitly pass `rcond=-1`.
  """Entry point for launching an IPython kernel.
```

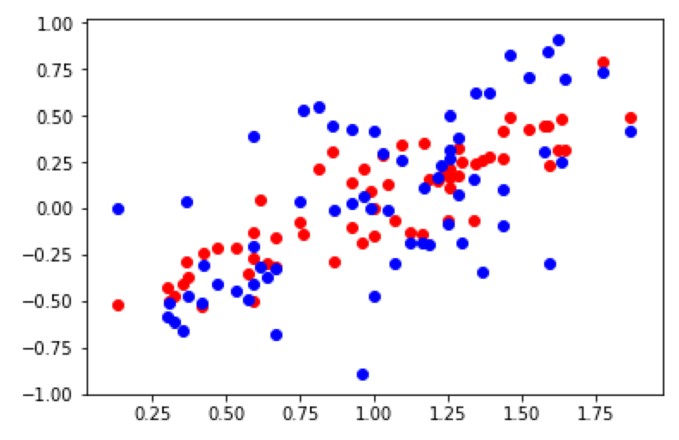
Out[20]:
```
array([ 3.20241053e-01,  2.75656281e-01,  2.85218671e-01, -8.06996665e-04,
       -8.20575701e-01])
```

In [50]:
```
pred = np.dot(x, beta)
```

3. Plot the model's prediction in 2D for 2 of the dimensions $(x_1 \rightarrow y_p, x_2 \rightarrow y_p)$ along with the original points

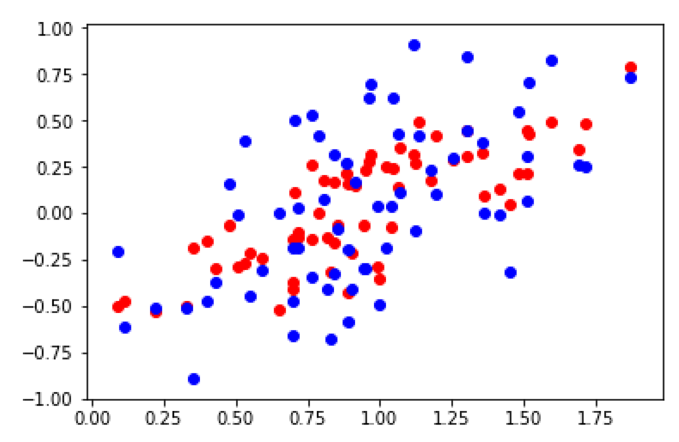
In [22]:
```
#plot dimension 1
plt.scatter(x.T[0], pred, c='red')
plt.scatter(x.T[0], y, c='blue')
```

Out[22]:
```
<matplotlib.collections.PathCollection at 0x2a968a536a0>
```



In [23]:
```
#plot dimension 2
plt.scatter(x.T[1], pred, c='red')
plt.scatter(x.T[1], y, c='blue')
```

Out[23]:
```
<matplotlib.collections.PathCollection at 0x2a968ab59b0>
```



4. Read in `mlnn/data/Credit.csv` with Pandas and create a model to predict Credit Rating (`Rating`). Use only the numeric columns in your model, but feel free to experiment which which columns you believe are better predicters of Credit Rating

In [5]:
```
import pandas as pd
credit = pd.read_csv('../data/Credit.csv')
credit.head()
```

Out[5]:

	Unnamed: 0	Income	Limit	Rating	Cards	Age	Education	Gender	Student	Married	Ethnicity	Balance
0	1	14.891	3606	283	2	34	11	Male	No	Yes	Caucasian	333
1	2	106.025	6645	483	3	82	15	Female	Yes	Yes	Asian	903
2	3	104.593	7075	514	4	71	11	Male	No	No	Asian	580
3	4	148.924	9504	681	3	36	11	Female	No	No	Asian	964
4	5	55.882	4897	357	2	68	16	Male	No	Yes	Caucasian	331

In [6]:
```
X = credit[['Income', 'Limit']].as_matrix()

X = np.vstack([X.T, np.ones(len(X))]).T
```

```
D:\Python\lib\site-packages\ipykernel_launcher.py:1: FutureWarning: Method .as_matrix will be re
moved in a future version. Use .values instead.
  """Entry point for launching an IPython kernel.
```

In [7]:
```
Y = credit['Rating']
```

In [8]:
```
left = np.linalg.inv(np.dot(X.T, X))
right = np.dot(Y.T, X)
np.dot(left, right)
beta = np.linalg.lstsq(X, Y)[0]
pred = np.dot(X, beta)
```

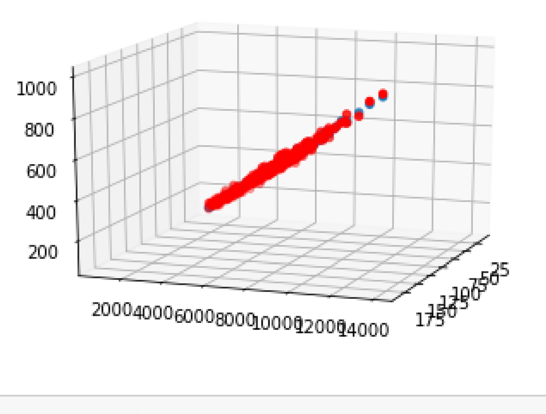
```
D:\Python\lib\site-packages\ipykernel_launcher.py:4: FutureWarning: `rcond` parameter will chang
e to the default of machine precision times ``max(M, N)`` where M and N are the input matrix dim
ensions.
To use the future default and silence this warning we advise to pass `rcond=None`, to keep using
the old, explicitly pass `rcond=-1`.
  after removing the cwd from sys.path.
```

5. Plot your results (Bonus if you use 3D plots). Show as many of your columns vs. credit rating that you can.

In [9]:
```
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D

fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.view_init(16,20)
ax.scatter(X.T[0], X.T[1], pred, zdir='z')
ax.scatter(X.T[0], X.T[1], Y, zdir='z', c='r')
```

Out[9]:
```
<mpl_toolkits.mplot3d.art3d.Path3DCollection at 0x2469ff35668>
```



In [10]:
```
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.view_init(16,20)
ax.scatter(X.T[0], X.T[2], pred, zdir='z')
ax.scatter(X.T[0], X.T[2], Y, zdir='z', c='r')
```

Out[10]:
```
<mpl_toolkits.mplot3d.art3d.Path3DCollection at 0x246a04a07f0>
```