In [1]:

```
import os
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [2]:

```
df=pd.read_csv("C:/sameer/heart - Copy (2).csv")
```

In [3]:

```
df.head(3)
```

Out[3]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
0	63	1	3	145	233	1	0	150	0	2.3	0	0	1	1
1	37	1	2	130	250	0	1	187	0	3.5	0	0	2	1
2	41	0	1	130	204	0	0	172	0	1.4	2	0	2	1

In [7]:

```
df.nunique()
```

Out[7]:

```
age          41
sex           2
cp            4
trestbps     49
chol        152
fbs           2
restecg       3
thalach      91
exang         2
oldpeak      40
slope         3
ca            5
thal          4
target        2
dtype: int64
```

In [8]:

```
df.loc[df['ca']==4]
```

Out[8]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
92	52	1	2	138	223	0	1	169	0	0.0	2	4	2	1
158	58	1	1	125	220	0	1	144	0	0.4	1	4	3	1
163	38	1	2	138	175	0	1	173	0	0.0	2	4	2	1
164	38	1	2	138	175	0	1	173	0	0.0	2	4	2	1
251	43	1	0	132	247	1	0	143	1	0.1	1	4	3	0

In [9]:

```
df.loc[df['ca']==4,'ca']=np.NaN
```

In [10]:

```
df['ca'].unique()
```

Out[10]:

```
array([ 0.,  2.,  1.,  3., nan])
```

In [11]:

```
df.thal.value_counts()
```

Out[11]:

```
2    166
3    117
1     18
0      2
Name: thal, dtype: int64
```

In [12]:

```
df.loc[df['thal']==0,'thal']=np.NaN
```

In [13]:

```
df[df['thal']==0]
```

Out[13]:

age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target

In [14]:

```
df['thal'].unique()
```

Out[14]:

```
array([ 1.,  2.,  3., nan])
```

In [15]:

```
df.isnull().sum()
```

Out[15]:

```
age         0
sex         0
cp          0
trestbps    0
chol        0
fbs         0
restecg     0
thalach     0
exang       0
oldpeak     0
slope       0
ca          5
thal        2
target      0
dtype: int64
```

In [16]:

```
df = df.fillna(df.median())
df.isnull().sum()
```

Out[16]:

```
age         0
sex         0
cp          0
trestbps    0
chol        0
fbs         0
restecg     0
thalach     0
exang       0
oldpeak     0
slope       0
ca          0
thal        0
target      0
dtype: int64
```

In [17]:

```
duplicates = df.duplicated(keep=False).sum()
duplicates
```

Out[17]:

2

In [18]:

```
duplicated=df[df.duplicated(keep=False)]
```

In [19]:

```
duplicated.head()
```

Out[19]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
163	38	1	2	138	175	0	1	173	0	0.0	2	0.0	2.0	1
164	38	1	2	138	175	0	1	173	0	0.0	2	0.0	2.0	1

In [20]:

```
df.describe()
```

Out[20]:

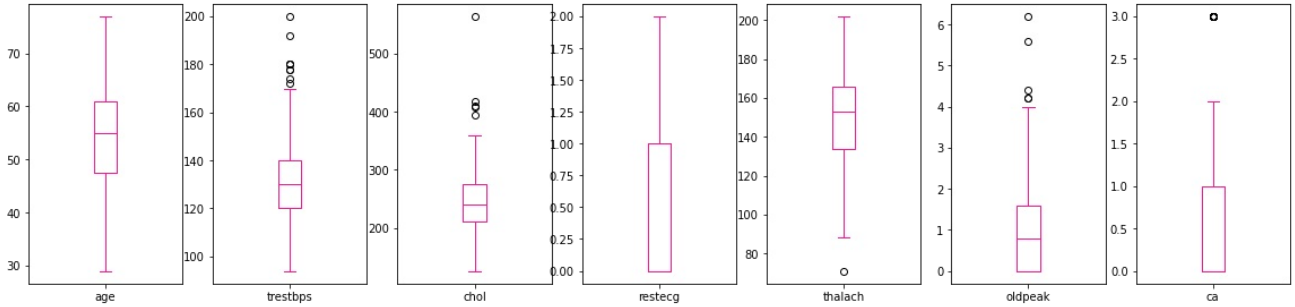
	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	
count	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.000000	303.0
mean	54.366337	0.683168	0.966997	131.623762	246.264026	0.148515	0.528053	149.646865	0.326733	1.039604	1.3
std	9.082101	0.466011	1.032052	17.538143	51.830751	0.356198	0.525860	22.905161	0.469794	1.161075	0.6
min	29.000000	0.000000	0.000000	94.000000	126.000000	0.000000	0.000000	71.000000	0.000000	0.000000	0.0
25%	47.500000	0.000000	0.000000	120.000000	211.000000	0.000000	0.000000	133.500000	0.000000	0.000000	1.0
50%	55.000000	1.000000	1.000000	130.000000	240.000000	0.000000	1.000000	153.000000	0.000000	0.800000	1.0
75%	61.000000	1.000000	2.000000	140.000000	274.500000	0.000000	1.000000	166.000000	1.000000	1.600000	2.0
max	77.000000	1.000000	3.000000	200.000000	564.000000	1.000000	2.000000	202.000000	1.000000	6.200000	2.0

In [21]:

```
df['target'] = df.target.replace({1: "Disease", 0: "No_disease"})
df['sex'] = df.sex.replace({1: "Male", 0: "Female"})
df['cp'] = df.cp.replace({0: "typical_angina",
                          1: "atypical_angina",
                          2:"non-anginal pain",
                          3: "asymtomatic"})
df['exang'] = df.exang.replace({1: "Yes", 0: "No"})
df['fbs'] = df.fbs.replace({1: "True", 0: "False"})
df['slope'] = df.slope.replace({0: "upsloping", 1: "flat",2:"downsloping"})
df['thal'] = df.thal.replace({1: "fixed_defect", 2: "reversable_defect", 3:"normal"})
```

In [22]:

```
df.plot(kind='box', subplots=True, layout=(2,7),
sharex=False,sharey=False, figsize=(20, 10),
color='deeppink');
```

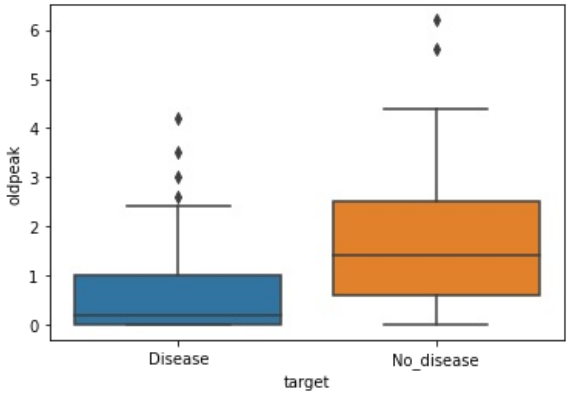


In [24]:

```
sns.boxplot(x='target', y='oldpeak', data=df)
```

Out[24]:

```
<AxesSubplot:xlabel='target', ylabel='oldpeak'>
```



In [25]:

```
continous_features = ['age','trestbps','chol','thalach','oldpeak']
def outliers(df_out, drop = False):
    for each_feature in df_out.columns:
        feature_data = df_out[each_feature]
        Q1 = np.percentile(feature_data, 25.) # 25th percentile of the data of the given feature
        Q3 = np.percentile(feature_data, 75.) # 75th percentile of the data of the given feature
        IQR = Q3-Q1 #Interquartile Range
        outlier_step = IQR * 1.5 #That's we were talking about above
        outliers = feature_data[~((feature_data >= Q1 - outlier_step) & (feature_data <= Q3 + outlier_step))].ind
ex.tolist()
        if not drop:
            print('For the feature {}, No of Outliers is {}'.format(each_feature, len(outliers)))
        if drop:
            df.drop(outliers, inplace = True, errors = 'ignore')
            print('Outliers from {} feature removed'.format(each_feature))

outliers(df[continous_features])
```

```
For the feature age, No of Outliers is 0
For the feature trestbps, No of Outliers is 9
For the feature chol, No of Outliers is 5
For the feature thalach, No of Outliers is 1
For the feature oldpeak, No of Outliers is 5
```

In [26]:

```
outliers(df[continous_features],drop=True)
```

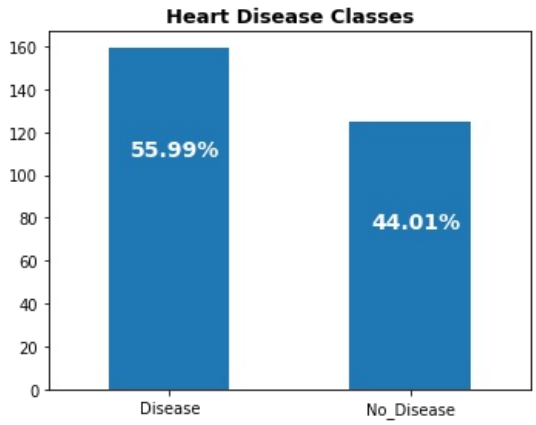
```
Outliers from age feature removed
Outliers from trestbps feature removed
Outliers from chol feature removed
Outliers from thalach feature removed
Outliers from oldpeak feature removed
```

In [27]:

```
print(df.target.value_counts())
fig, ax = plt.subplots(figsize=(5,4))
name = ["Disease", "No_Disease"]
ax = df.target.value_counts().plot(kind='bar')
ax.set_title("Heart Disease Classes", fontsize = 13, weight = 'bold')
ax.set_xticklabels (name, rotation = 0)
totals = []
for i in ax.patches:
    totals.append(i.get_height())
total = sum(totals)
for i in ax.patches:
    ax.text(i.get_x()+.09, i.get_height()-50, \
            str(round((i.get_height()/total)*100, 2))+'%', fontsize=14,
                color='white', weight = 'bold')

plt.tight_layout()
```

```
Disease       159
No_disease    125
Name: target, dtype: int64
```



In [ ]:

```
```