

```
In [148... import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

```
In [149... ds1=pd.read_csv('Release1.csv')
```

```
In [150... f1=ds1.fillna(0)
```

```
In [151... f1
```

```
Out[151]:
```

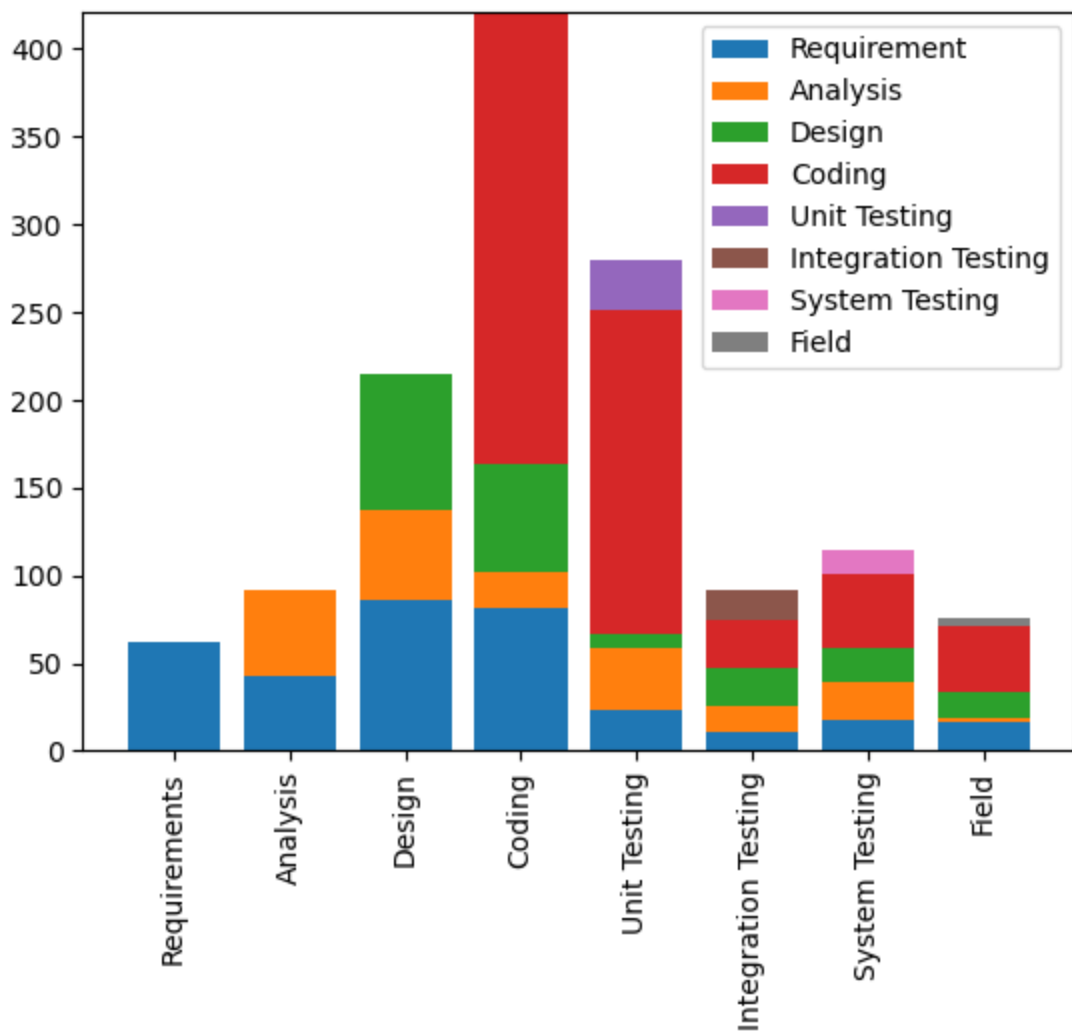
	Requirements	Analysis	Design	Coding	UnitTesting	IntegrationTesting	SystemTesting	Field
0	62	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	43	49.0	0.0	0.0	0.0	0.0	0.0	0.0
2	86	51.0	78.0	0.0	0.0	0.0	0.0	0.0
3	81	21.0	61.0	258.0	0.0	0.0	0.0	0.0
4	23	35.0	8.0	185.0	29.0	0.0	0.0	0.0
5	11	15.0	21.0	27.0	0.0	18.0	0.0	0.0
6	18	21.0	19.0	43.0	0.0	0.0	13.0	0.0
7	16	3.0	15.0	37.0	0.0	0.0	0.0	5.0

```
In [152... x=['Requirements','Analysis','Design','Coding','Unit Testing','Integration Testing', 'Sy
y1=f1.Requirements
y2=f1.Analysis
y3=f1.Design
y4=f1.Coding
y5=f1.UnitTesting
y6=f1.IntegrationTesting
y7=f1.SystemTesting
y8=f1.Field

plt.bar(x,y1)
plt.bar(x,y2,bottom=y1)
plt.bar(x,y3,bottom=y1+y2)
plt.bar(x,y4,bottom=y1+y2+y3)
plt.bar(x,y5,bottom=y1+y2+y3+y4)
plt.bar(x,y6,bottom=y1+y2+y3+y4+y5)
plt.bar(x,y7,bottom=y1+y2+y3+y4+y5+y6)
plt.bar(x,y8,bottom=y1+y2+y3+y4+y5+y6+y7)

plt.xticks(rotation=90)
plt.legend(['Requirement', 'Analysis', 'Design', 'Coding', 'Unit Testing','Integration T
```

```
Out[152]: <matplotlib.legend.Legend at 0x21e9f1b27a0>
```



```
In [153... ds2=pd.read_csv('Release2.csv')
```

```
In [154... f2=ds2.fillna(0)
```

```
In [155... f2
```

Out[155]:

	Requirements	Analysis	Design	Coding	UnitTesting	IntegrationTesting	SystemTesting	Field
0	88	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	9	81.0	0.0	0.0	0.0	0.0	0.0	0.0
2	48	31.0	99.0	0.0	0.0	0.0	0.0	0.0
3	65	9.0	23.0	347.0	0.0	0.0	0.0	0.0
4	9	18.0	5.0	56.0	17.0	0.0	0.0	0.0
5	7	5.0	6.0	17.0	0.0	8.0	0.0	0.0
6	11	7.0	3.0	16.0	0.0	0.0	5.0	0.0
7	3	4.0	3.0	4.0	0.0	0.0	0.0	4.0

```
In [156... x=['Requirements','Analysis','Design','Coding','Unit Testing','Integration Testing', 'Sy
y1=f2.Requirements
y2=f2.Analysis
y3=f2.Design
y4=f2.Coding
y5=f2.UnitTesting
y6=f2.IntegrationTesting
```

```

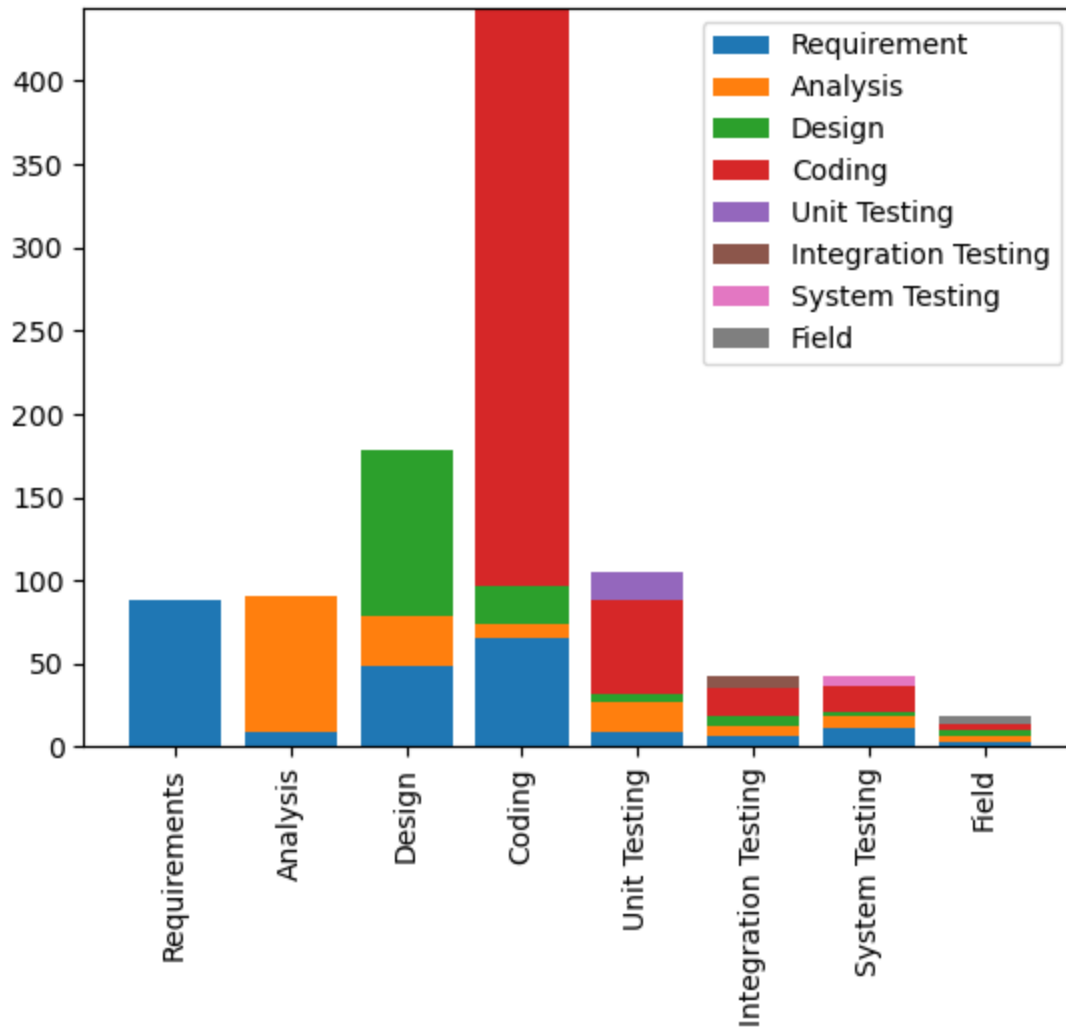
y7=f2.SystemTesting
y8=f2.Field

plt.bar(x,y1)
plt.bar(x,y2,bottom=y1)
plt.bar(x,y3,bottom=y1+y2)
plt.bar(x,y4,bottom=y1+y2+y3)
plt.bar(x,y5,bottom=y1+y2+y3+y4)
plt.bar(x,y6,bottom=y1+y2+y3+y4+y5)
plt.bar(x,y7,bottom=y1+y2+y3+y4+y5+y6)
plt.bar(x,y8,bottom=y1+y2+y3+y4+y5+y6+y7)

plt.xticks(rotation=90)
plt.legend(['Requirement', 'Analysis', 'Design', 'Coding', 'Unit Testing','Integration T

```

Out[156]: <matplotlib.legend.Legend at 0x21e9f959cc0>



In [157]: ds3=pd.read_csv('Release3.csv')

In [158]: f3=ds3.fillna(0)

In [159]: f3

Out[159]:

	Requirements	Analysis	Design	Coding	UnitTesting	IntegrationTesting	SystemTesting	Field
0	69	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	26	59.0	0.0	0.0	0.0	0.0	0.0	0.0
2	51	41.0	89.0	0.0	0.0	0.0	0.0	0.0
3	29	11.0	38.0	289.0	0.0	0.0	0.0	0.0

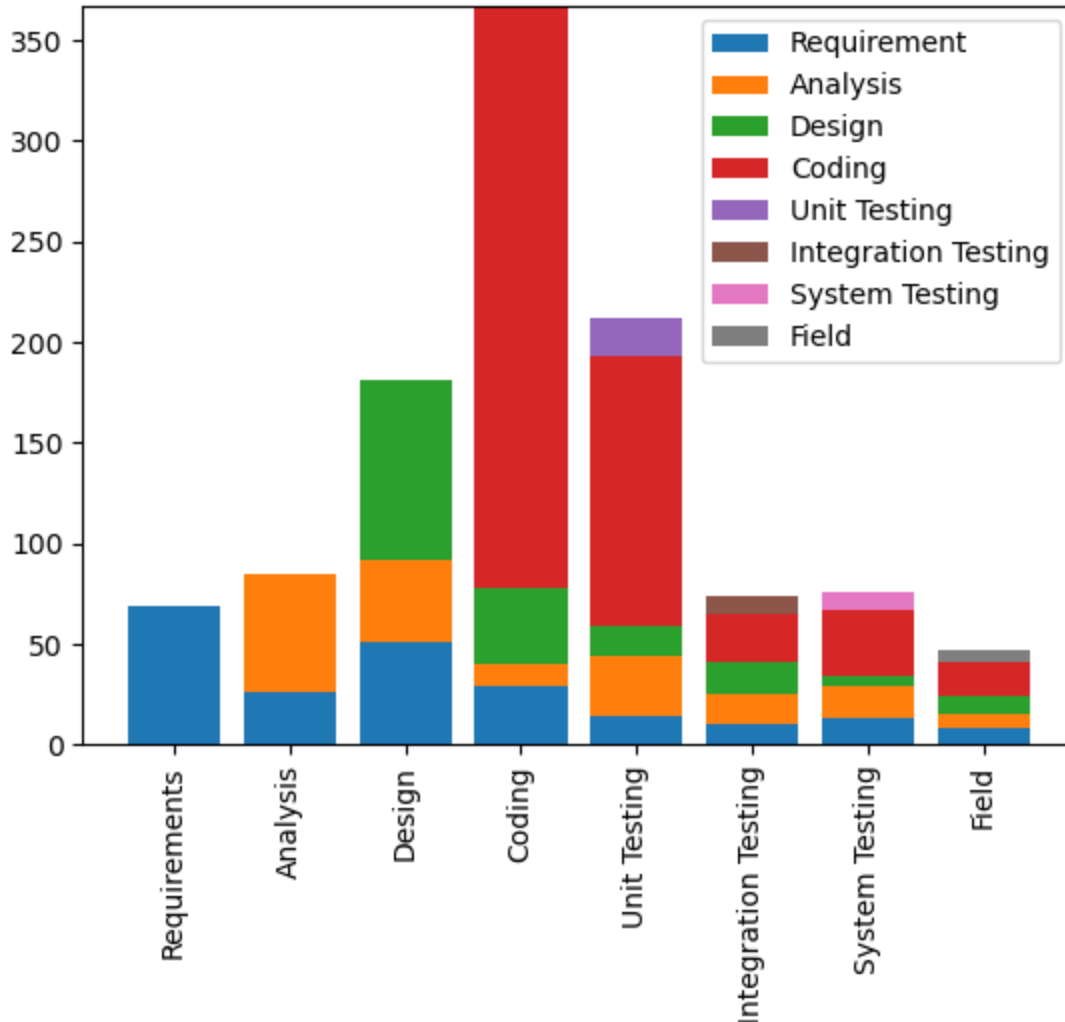
4	14	30.0	15.0	134.0	19.0	0.0	0.0	0.0
5	10	15.0	16.0	24.0	0.0	9.0	0.0	0.0
6	13	16.0	5.0	33.0	0.0	0.0	9.0	0.0
7	8	7.0	9.0	17.0	0.0	0.0	0.0	6.0

```
In [160]: x=['Requirements','Analysis','Design','Coding','Unit Testing','Integration Testing','System Testing','Field']
y1=f3.Requirements
y2=f3.Analysis
y3=f3.Design
y4=f3.Coding
y5=f3.UnitTesting
y6=f3.IntegrationTesting
y7=f3.SystemTesting
y8=f3.Field

plt.bar(x,y1)
plt.bar(x,y2,bottom=y1)
plt.bar(x,y3,bottom=y1+y2)
plt.bar(x,y4,bottom=y1+y2+y3)
plt.bar(x,y5,bottom=y1+y2+y3+y4)
plt.bar(x,y6,bottom=y1+y2+y3+y4+y5)
plt.bar(x,y7,bottom=y1+y2+y3+y4+y5+y6)
plt.bar(x,y8,bottom=y1+y2+y3+y4+y5+y6+y7)

plt.xticks(rotation=90)
plt.legend(['Requirement', 'Analysis', 'Design', 'Coding', 'Unit Testing','Integration T
```

Out[160]: <matplotlib.legend.Legend at 0x21e9d7fa4a0>



```
In [161... ds4=pd.read_csv('Release4.csv')
```

```
In [162... f4=ds4.fillna(0)
```

```
In [163... f4
```

Out[163]:

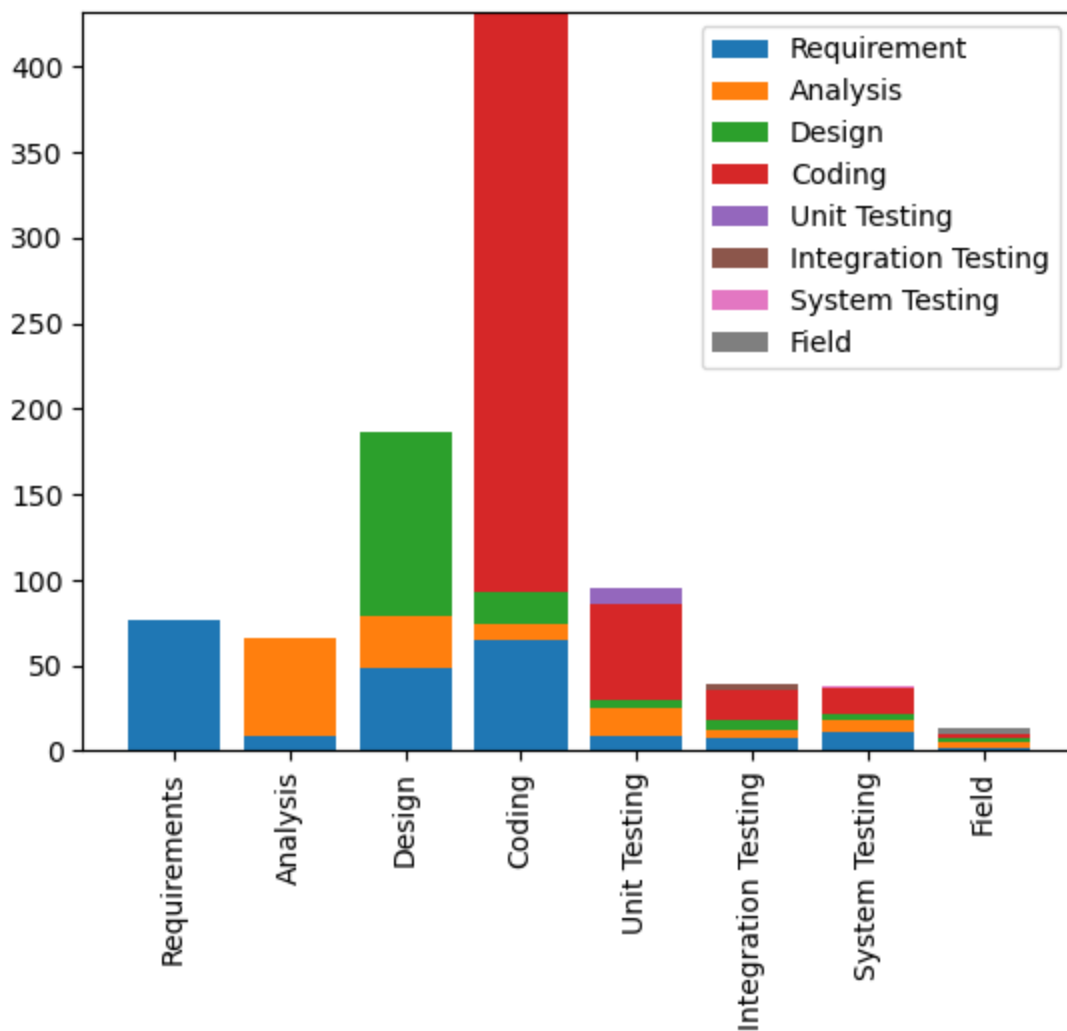
	Requirements	Analysis	Design	Coding	UnitTesting	IntegrationTesting	SystemTesting	Field
0	77	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	9	57.0	0.0	0.0	0.0	0.0	0.0	0.0
2	48	31.0	107.0	0.0	0.0	0.0	0.0	0.0
3	65	9.0	19.0	339.0	0.0	0.0	0.0	0.0
4	9	16.0	5.0	56.0	9.0	0.0	0.0	0.0
5	7	5.0	6.0	17.0	0.0	4.0	0.0	0.0
6	11	7.0	3.0	16.0	0.0	0.0	1.0	0.0
7	2	3.0	2.0	3.0	0.0	0.0	0.0	3.0

```
In [164... x=['Requirements','Analysis','Design','Coding','Unit Testing','Integration Testing', 'Sy
y1=f4.Requirements
y2=f4.Analysis
y3=f4.Design
y4=f4.Coding
y5=f4.UnitTesting
y6=f4.IntegrationTesting
y7=f4.SystemTesting
y8=f4.Field
```

```
plt.bar(x,y1)
plt.bar(x,y2,bottom=y1)
plt.bar(x,y3,bottom=y1+y2)
plt.bar(x,y4,bottom=y1+y2+y3)
plt.bar(x,y5,bottom=y1+y2+y3+y4)
plt.bar(x,y6,bottom=y1+y2+y3+y4+y5)
plt.bar(x,y7,bottom=y1+y2+y3+y4+y5+y6)
plt.bar(x,y8,bottom=y1+y2+y3+y4+y5+y6+y7)

plt.xticks(rotation=90)
plt.legend(['Requirement', 'Analysis', 'Design', 'Coding', 'Unit Testing','Integration T
```

Out[164]: <matplotlib.legend.Legend at 0x21e9f1b0a90>



```
In [165... ds5=pd.read_csv('Release5.csv')
```

```
In [166... f5=ds5.fillna(0)
```

```
In [167... f5
```

Out[167]:

	Requirements	Analysis	Design	Coding	UnitTesting	IntegrationTesting	SystemTesting	Field
0	61	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	26	4239.0	0.0	0.0	0.0	0.0	0.0	0.0
2	51	41.0	86.0	0.0	0.0	0.0	0.0	0.0
3	69	11.0	34.0	267.0	0.0	0.0	0.0	0.0
4	14	30.0	15.0	134.0	15.0	0.0	0.0	0.0
5	9	15.0	16.0	23.0	0.0	6.0	0.0	0.0
6	13	16.0	5.0	33.0	0.0	0.0	4.0	0.0
7	7	6.0	8.0	16.0	0.0	0.0	0.0	4.0

```
In [168... x=['Requirements','Analysis','Design','Coding','Unit Testing','Integration Testing', 'Sy
y1=f5.Requirements
y2=f5.Analysis
y3=f5.Design
y4=f5.Coding
y5=f5.UnitTesting
y6=f5.IntegrationTesting
```

```

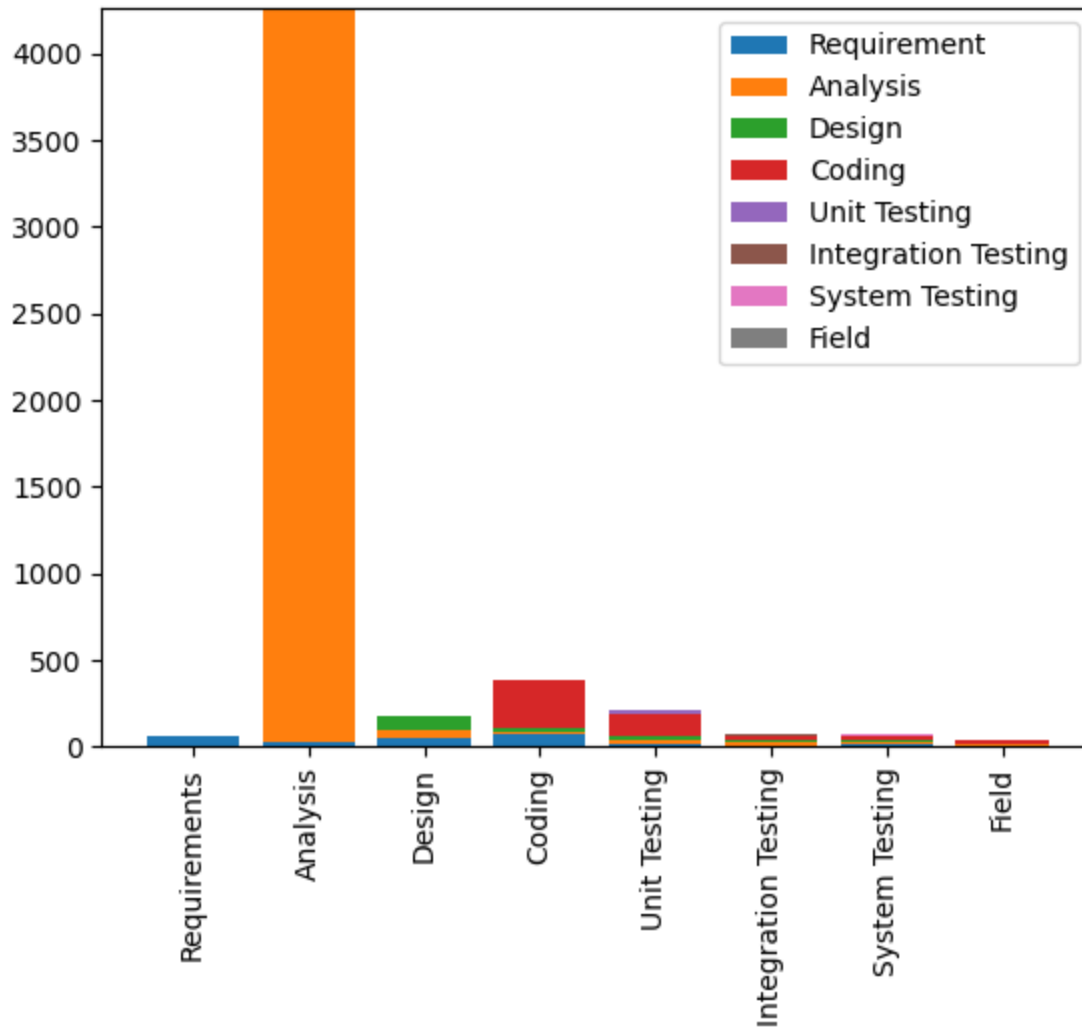
y7=f5.SystemTesting
y8=f5.Field

plt.bar(x,y1)
plt.bar(x,y2,bottom=y1)
plt.bar(x,y3,bottom=y1+y2)
plt.bar(x,y4,bottom=y1+y2+y3)
plt.bar(x,y5,bottom=y1+y2+y3+y4)
plt.bar(x,y6,bottom=y1+y2+y3+y4+y5)
plt.bar(x,y7,bottom=y1+y2+y3+y4+y5+y6)
plt.bar(x,y8,bottom=y1+y2+y3+y4+y5+y6+y7)

plt.xticks(rotation=90)
plt.legend(['Requirement', 'Analysis', 'Design', 'Coding', 'Unit Testing','Integration T

```

Out[168]: <matplotlib.legend.Legend at 0x21ea1061930>



```

In [169... def DRE(df) :
    Keys = ['Requirements','Analysis','Design','Coding','Unit Testing','Integration Test
    Horizontal=[]
    Vertical=[]
    Vertical=df.sum()
    Horizontal=df.sum(axis=1)
    drelist=[]
    T=0
    T1=0
    T2=Horizontal[4]+Horizontal[5]+Horizontal[6]+Horizontal[7]
    for i in range(8):
        if i==0:
            T=T+Vertical[i]
            drelist.append("{:.2f}".format((Horizontal[i]/T)*100))
        elif (i<4 and i>0):

```

```

        T=T1+Horizontal[i-1]
        T=T+Vertical[i]
        drelist.append("{:.2f}".format((Horizontal[i]/(T-T1))*100))
    else:
        drelist.append("{:.2f}".format((Horizontal[i]/(T2)*100)))
        T2 = T2 - Horizontal[i]
    return drelist
def overall_defect_removal_effectiveness(df):
    Horizontal=[]
    Vertical=[]
    Vertical=df.sum()
    Horizontal=df.sum(axis=1)
    totaldefects=sum(Vertical)
    S=(1-(Horizontal[7]/totaldefects))*100
    S=round(S, 2)
    return S
def detected(df):
    Horizontal=[]
    Horizontal=df.sum(axis=1)
    g=df.assign(Detected=Horizontal)
    return g
def injected(df):
    Vertical = []
    for i in range(8):
        Vertical.append(sum(df.iloc[:,i]))
    g = df.assign(Injected = Vertical)
    return g
def escaped(n,df):
    escapeval = []
    horizontal_col = []
    vertical_col = []
    for i in range(8):
        horizontal_col.append(sum(df.iloc[i,0:]))
        vertical_col.append(sum(df.iloc[:,i]))
    T1 = 0
    T2 = 0
    for i in range(8):
        escapeval.append(vertical_col[i]+T1-T2)
        T1 = T1 + vertical_col[i]
        T2 = T2 + horizontal_col[i]
    n= n.assign(Escaped = escapeval)
    return n
def defect_entry(df):
    entry = [0]
    for i in range(1,8):
        entry.append(df.Escaped[i-1])
    df= df.assign(DefectsOnEntryStep = entry)
    return df
def Defect_removal_efficiency(dfnew,df):
    dfnew= dfnew.assign(DRE = DRE(df))
    return dfnew

```

```

In [170]: h1=detected(f1)
h1=injected(h1)
h1=escaped(h1,f1)
h1=defects_on_entry_step(h1)
h1=Defect_removal_efficiency(h1,f1)
h1

```

```

Out[170]:

```

	Requirements	Analysis	Design	Coding	UnitTesting	IntegrationTesting	SystemTesting	Field	Detected	Injec
0	62	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.0	34
1	43	49.0	0.0	0.0	0.0	0.0	0.0	0.0	92.0	19
2	86	51.0	78.0	0.0	0.0	0.0	0.0	0.0	215.0	20

3	81	21.0	61.0	258.0	0.0	0.0	0.0	0.0	421.0	59.0
4	23	35.0	8.0	185.0	29.0	0.0	0.0	0.0	280.0	19.0
5	11	15.0	21.0	27.0	0.0	18.0	0.0	0.0	92.0	7.0
6	18	21.0	19.0	43.0	0.0	0.0	13.0	0.0	114.0	8.0
7	16	3.0	15.0	37.0	0.0	0.0	0.0	5.0	76.0	5.0

In [171...

overall_defect_removal_effectiveness(f1)

Out[171]: 94.38

In [172...

h2=detected(f2)
h2=injected(h2)
h2=escaped(h2,f2)
h2=defects_on_entry_step(h2)
h2=Defect_removal_efficiency(h2,f2)
h2

Out[172]:

	Requirements	Analysis	Design	Coding	UnitTesting	IntegrationTesting	SystemTesting	Field	Detected	Injec
0	88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.0	24.0
1	9	81.0	0.0	0.0	0.0	0.0	0.0	0.0	90.0	19.0
2	48	31.0	99.0	0.0	0.0	0.0	0.0	0.0	178.0	19.0
3	65	9.0	23.0	347.0	0.0	0.0	0.0	0.0	444.0	49.0
4	9	18.0	5.0	56.0	17.0	0.0	0.0	0.0	105.0	7.0
5	7	5.0	6.0	17.0	0.0	8.0	0.0	0.0	43.0	5.0
6	11	7.0	3.0	16.0	0.0	0.0	5.0	0.0	42.0	8.0
7	3	4.0	3.0	4.0	0.0	0.0	0.0	4.0	18.0	5.0

In [173...

overall_defect_removal_effectiveness(f2)

Out[173]: 98.21

In [174...

h3=detected(f3)
h3=injected(h3)
h3=escaped(h3,f3)
h3=defects_on_entry_step(h3)
h3=Defect_removal_efficiency(h3,f3)
h3

Out[174]:

	Requirements	Analysis	Design	Coding	UnitTesting	IntegrationTesting	SystemTesting	Field	Detected	Injec
0	69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.0	24.0
1	26	59.0	0.0	0.0	0.0	0.0	0.0	0.0	85.0	19.0
2	51	41.0	89.0	0.0	0.0	0.0	0.0	0.0	181.0	19.0
3	29	11.0	38.0	289.0	0.0	0.0	0.0	0.0	367.0	49.0
4	14	30.0	15.0	134.0	19.0	0.0	0.0	0.0	212.0	7.0
5	10	15.0	16.0	24.0	0.0	9.0	0.0	0.0	74.0	5.0
6	13	16.0	5.0	33.0	0.0	0.0	9.0	0.0	76.0	8.0
7	3	4.0	3.0	4.0	0.0	0.0	0.0	4.0	18.0	5.0

7	8	7.0	9.0	17.0	0.0	0.0	0.0	6.0	47.0
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```
In [175]: overall_defect_removal_effectiveness(f3)
```

Out[175]: 95.77

```
In [176]: h4=detected(f4)
h4=injected(h4)
h4=escaped(h4,f4)
h4=defects_on_entry_step(h4)
h4=Defect_removal_efficiency(h4,f4)
h4
```

Out[176]:	Requirements	Analysis	Design	Coding	UnitTesting	IntegrationTesting	SystemTesting	Field	Detected	Injec
0	77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.0	2
1	9	57.0	0.0	0.0	0.0	0.0	0.0	0.0	66.0	1
2	48	31.0	107.0	0.0	0.0	0.0	0.0	0.0	186.0	14
3	65	9.0	19.0	339.0	0.0	0.0	0.0	0.0	432.0	43
4	9	16.0	5.0	56.0	9.0	0.0	0.0	0.0	95.0	
5	7	5.0	6.0	17.0	0.0	4.0	0.0	0.0	39.0	
6	11	7.0	3.0	16.0	0.0	0.0	1.0	0.0	38.0	
7	2	3.0	2.0	3.0	0.0	0.0	0.0	3.0	13.0	

```
In [177]: overall_defect_removal_effectiveness(f4)
```

Out[177]: 98.63

```
In [178]: h5=detected(f5)
h5=injected(h5)
h5=escaped(h5,f5)
h5=defects_on_entry_step(h5)
h5=Defect_removal_efficiency(h5,f5)
h5
```

Out[178]:	Requirements	Analysis	Design	Coding	UnitTesting	IntegrationTesting	SystemTesting	Field	Detected	Injec
0	61	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.0	2
1	26	4239.0	0.0	0.0	0.0	0.0	0.0	0.0	4265.0	43
2	51	41.0	86.0	0.0	0.0	0.0	0.0	0.0	178.0	16
3	69	11.0	34.0	267.0	0.0	0.0	0.0	0.0	381.0	4
4	14	30.0	15.0	134.0	15.0	0.0	0.0	0.0	208.0	
5	9	15.0	16.0	23.0	0.0	6.0	0.0	0.0	69.0	
6	13	16.0	5.0	33.0	0.0	0.0	4.0	0.0	71.0	
7	7	6.0	8.0	16.0	0.0	0.0	0.0	4.0	41.0	

```
In [179]: overall_defect_removal_effectiveness(f5)
```

Out[179]: 99.22

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