In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [3]:
```
df = pd.read_csv(r"D:\tsunami_earthquake_dataset.csv")
```

In [5]:
```
print(df)
```

	date	latitude	longitude	magnitude	depth	tsunami
0	2001-01-01	-60.0	120.0	5.0	5	1
1	2001-06-30	-57.6	118.2	5.6	12	0
2	2001-12-27	-55.2	116.4	6.2	19	0
3	2002-06-25	-52.8	114.6	6.8	26	0
4	2002-12-22	-50.4	112.8	7.4	33	1
5	2003-06-20	-48.0	111.0	8.0	40	0
6	2003-12-17	-45.6	109.2	5.0	47	0
7	2004-06-14	-43.2	107.4	5.6	54	0
8	2004-12-11	-40.8	105.6	6.2	61	1
9	2005-06-09	-38.4	103.8	6.8	68	0
10	2005-12-06	-36.0	102.0	7.4	5	0
11	2006-06-04	-33.6	100.2	8.0	12	0
12	2006-12-01	-31.2	98.4	5.0	19	1
13	2007-05-30	-28.8	96.6	5.6	26	0
14	2007-11-26	-26.4	94.8	6.2	33	0
15	2008-05-24	-24.0	93.0	6.8	40	0
16	2008-11-20	-21.6	91.2	7.4	47	1
17	2009-05-19	-19.2	89.4	8.0	54	0
18	2009-11-15	-16.8	87.6	5.0	61	0
19	2010-05-14	-14.4	85.8	5.6	68	0
20	2010-11-10	-12.0	84.0	6.2	5	1
21	2011-05-09	-9.6	82.2	6.8	12	0
22	2011-11-05	-7.2	80.4	7.4	19	0
23	2012-05-03	-4.8	78.6	8.0	26	0
24	2012-10-30	-2.4	76.8	5.0	33	1
25	2013-04-28	0.0	75.0	5.6	40	0
26	2013-10-25	2.4	73.2	6.2	47	0
27	2014-04-23	4.8	71.4	6.8	54	0
28	2014-10-20	7.2	69.6	7.4	61	1
29	2015-04-18	9.6	67.8	8.0	68	0
30	2015-10-15	12.0	66.0	5.0	5	0
31	2016-04-12	14.4	64.2	5.6	12	0
32	2016-10-09	16.8	62.4	6.2	19	1
33	2017-04-07	19.2	60.6	6.8	26	0
34	2017-10-04	21.6	58.8	7.4	33	0
35	2018-04-02	24.0	57.0	8.0	40	0
36	2018-09-29	26.4	55.2	5.0	47	1
37	2019-03-28	28.8	53.4	5.6	54	0
38	2019-09-24	31.2	51.6	6.2	61	0
39	2020-03-22	33.6	49.8	6.8	68	0
40	2020-09-18	36.0	48.0	7.4	5	1
41	2021-03-17	38.4	46.2	8.0	12	0
42	2021-09-13	40.8	44.4	5.0	19	0
43	2022-03-12	43.2	42.6	5.6	26	0
44	2022-09-08	45.6	40.8	6.2	33	1
45	2023-03-07	48.0	39.0	6.8	40	0
46	2023-09-03	50.4	37.2	7.4	47	0
47	2024-03-01	52.8	35.4	8.0	54	0
48	2024-08-28	55.2	33.6	5.0	61	1
49	2025-02-24	57.6	31.8	5.6	68	0

In [7]:
```
df.head(5)
```

Out[7]:

	date	latitude	longitude	magnitude	depth	tsunami
0	2001-01-01	-60.0	120.0	5.0	5	1
1	2001-06-30	-57.6	118.2	5.6	12	0
2	2001-12-27	-55.2	116.4	6.2	19	0
3	2002-06-25	-52.8	114.6	6.8	26	0
4	2002-12-22	-50.4	112.8	7.4	33	1

In [8]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50 entries, 0 to 49
Data columns (total 6 columns):
 #   Column     Non-Null Count  Dtype  
---  ------     --------------  -----  
 0   date       50 non-null     object 
 1   latitude   50 non-null     float64
 2   longitude  50 non-null     float64
 3   magnitude  50 non-null     float64
 4   depth      50 non-null     int64  
 5   tsunami    50 non-null     int64  
dtypes: float64(3), int64(2), object(1)
memory usage: 2.5+ KB
```

In [9]:
```
df.describe()
```

Out[9]:

	latitude	longitude	magnitude	depth	tsunami
count	50.000000	50.000000	50.000000	50.000000	50.000000
mean	-1.200000	75.900000	6.452000	36.500000	0.260000
std	34.985711	26.239284	1.043393	20.310096	0.443087
min	-60.000000	31.800000	5.000000	5.000000	0.000000
25%	-30.600000	53.850000	5.600000	19.000000	0.000000
50%	-1.200000	75.900000	6.200000	36.500000	0.000000
75%	28.200000	97.950000	7.400000	54.000000	0.750000
max	57.600000	120.000000	8.000000	68.000000	1.000000

In [10]:
```
df['date']=pd.to_datetime(df['date'])
df['year']=df['date'].dt.year
```

In [11]:
```
df.info()
```

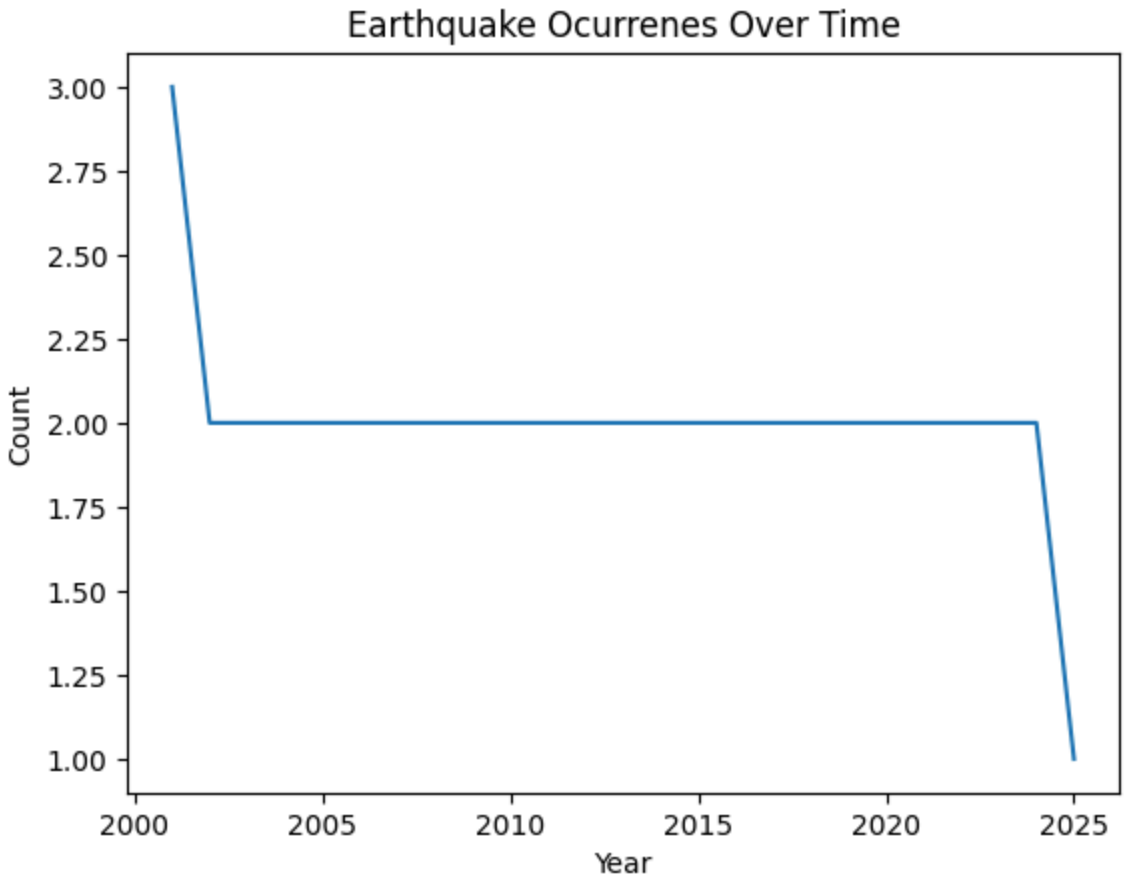
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50 entries, 0 to 49
Data columns (total 7 columns):
 #   Column     Non-Null Count  Dtype         
---  ------     --------------  -----         
 0   date       50 non-null     datetime64[ns]
 1   latitude   50 non-null     float64       
 2   longitude  50 non-null     float64       
 3   magnitude  50 non-null     float64       
 4   depth      50 non-null     int64         
 5   tsunami    50 non-null     int64         
 6   year       50 non-null     int32         
dtypes: datetime64[ns](1), float64(3), int32(1), int64(2)
memory usage: 2.7 KB
```

In [18]:
```
df.isnull().sum()
```

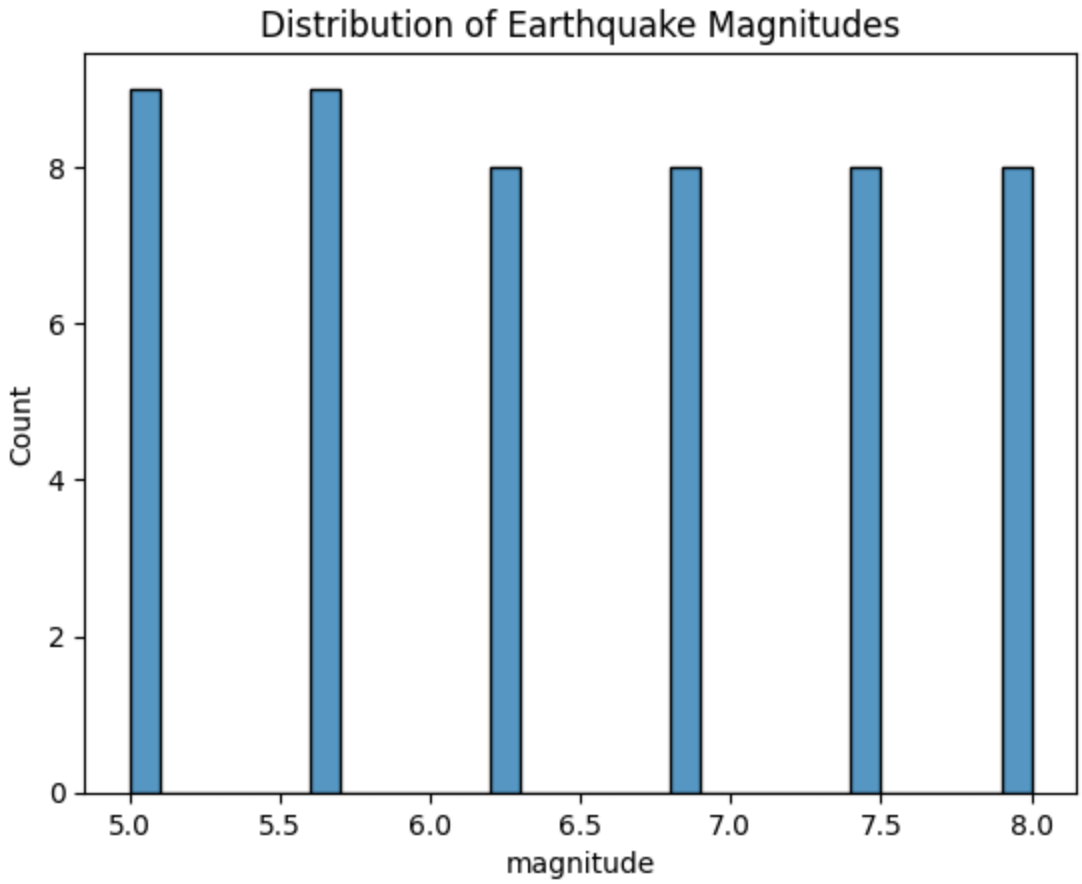
Out[18]:
```
date         0
latitude     0
longitude    0
magnitude    0
depth        0
tsunami      0
year         0
dtype: int64
```

In [12]:
```
df.dropna(inplace=True)
```

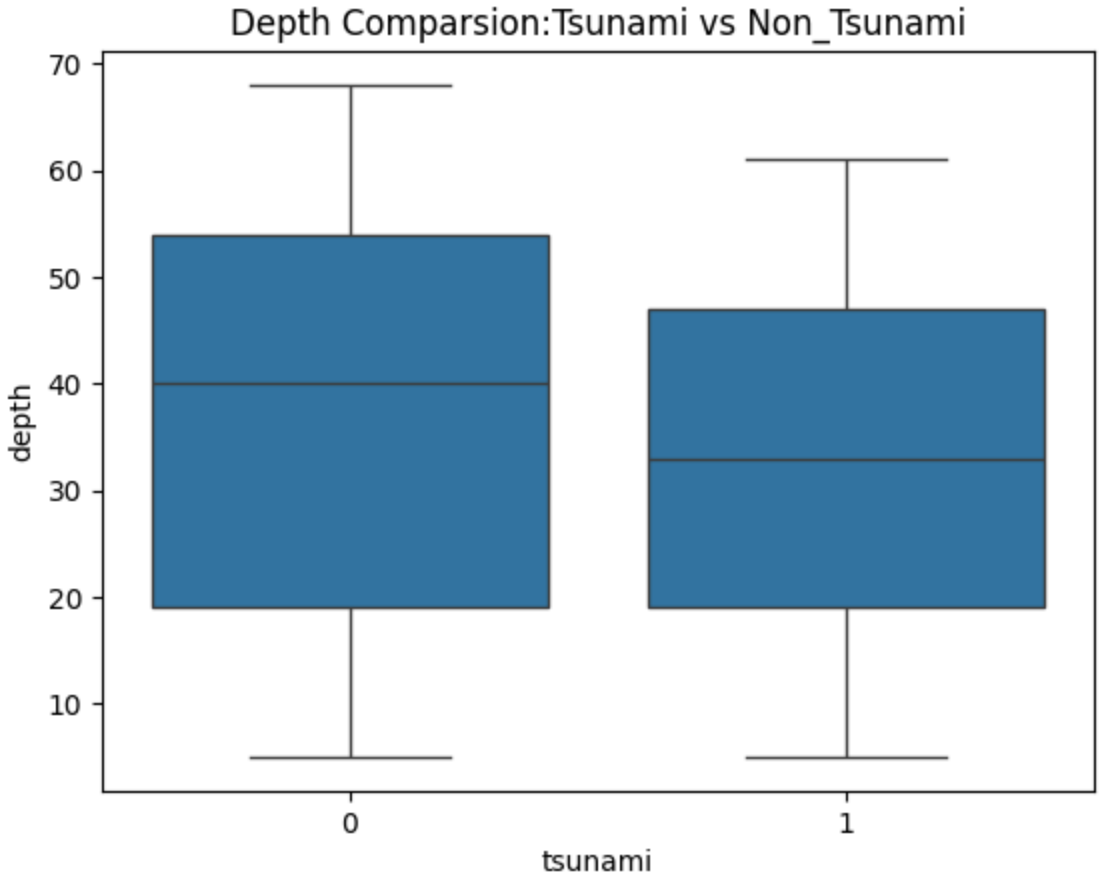
In [15]:
```
# Time_Based Analysis

plt.figure()
df.groupby('year').size().plot()
plt.title("Earthquake Ocurrenes Over Time")
plt.xlabel("Year")
plt.ylabel("Count")
plt.show()
```



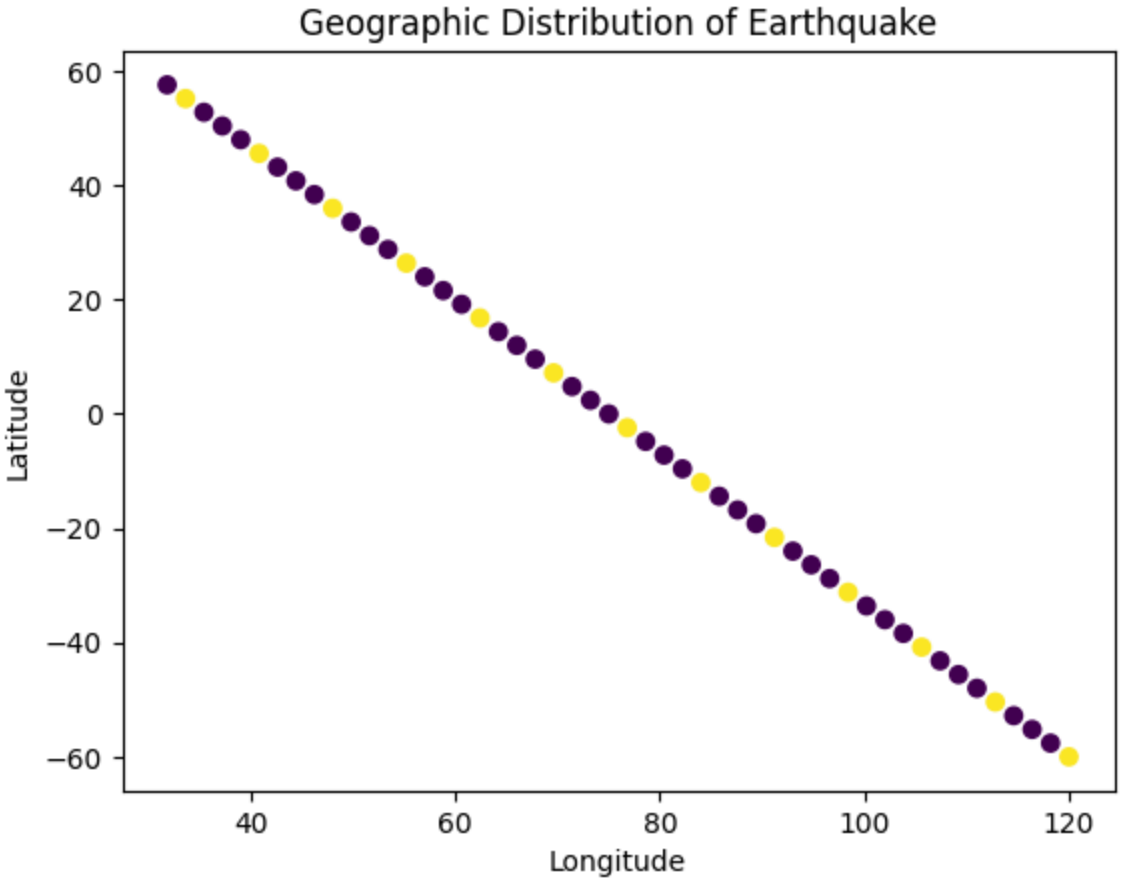
In [27]:
```
#Magnitude Distribution

plt.figure()
sns.histplot(df['magnitude'],bins=30)
plt.title("Distribution of Earthquake Magnitudes")
plt.show()
```



In [20]:
```
# Depth vs Tsunami Comparsion

plt.figure()
sns.boxplot(x='tsunami',y='depth',data=df)
plt.title("Depth Comparsion:Tsunami vs Non_Tsunami")
plt.show()
```



In [22]:
```
#Geographic Distribution

plt.figure()
plt.scatter (df['longitude'],df['latitude'], c=df['tsunami'])
plt.xlabel("Longitude")
plt.ylabel("Latitude")
plt.title("Geographic Distribution of Earthquake")
plt.show()
```



In [29]:
```
# Major Earthquakes (Magnitude ≥ 8.0)

major_eq = df[df['magnitude'] >= 8.0]

print("Total Major Earthquakes (Magnitude ≥ 8.0):", major_eq.shape[0])
major_eq.head()
```

```
Total Major Earthquakes (Magnitude ≥ 8.0): 8
```

Out[29]:

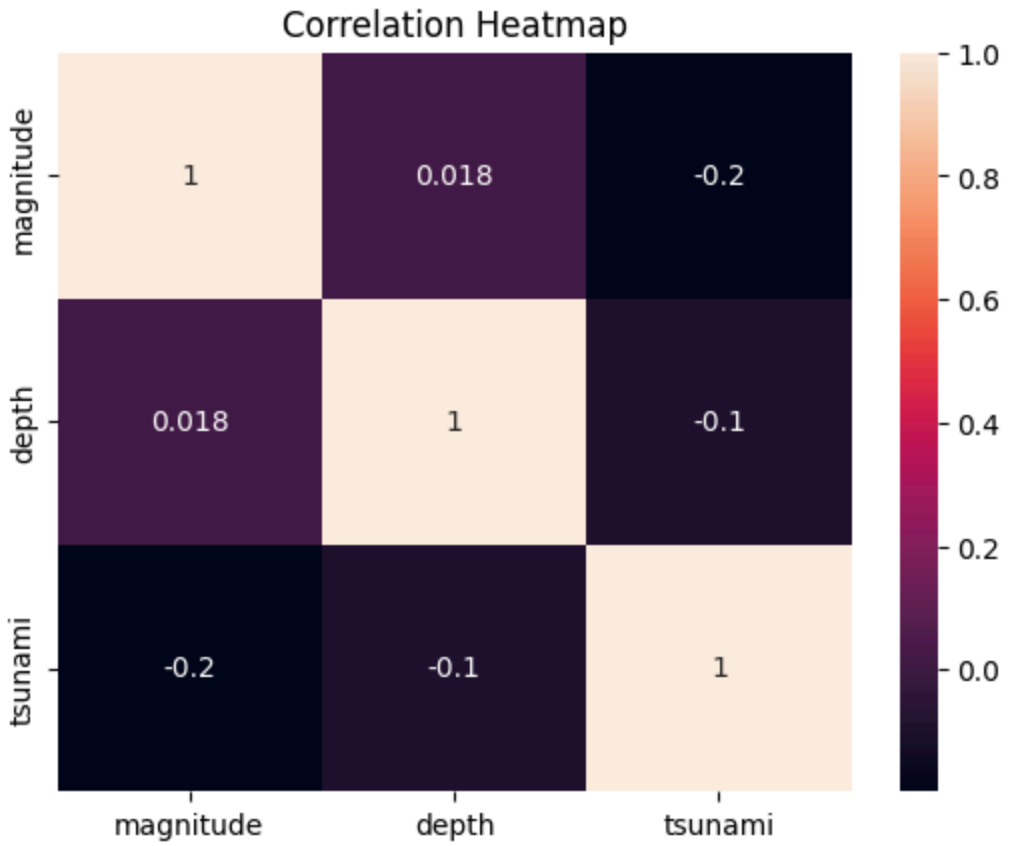
	date	latitude	longitude	magnitude	depth	tsunami	year	Magnitude_F
5	2003-06-20	-48.0	111.0	8.0	40	0	2003	7
11	2006-06-04	-33.6	100.2	8.0	12	0	2006	7
17	2009-05-19	-19.2	89.4	8.0	54	0	2009	7
23	2012-05-03	-4.8	78.6	8.0	26	0	2012	7
29	2015-04-18	9.6	67.8	8.0	68	0	2015	7

In [30]:
```
# Statistical summary of major earthquakes

major_eq[['magnitude', 'depth']].describe()
```

Out[30]:

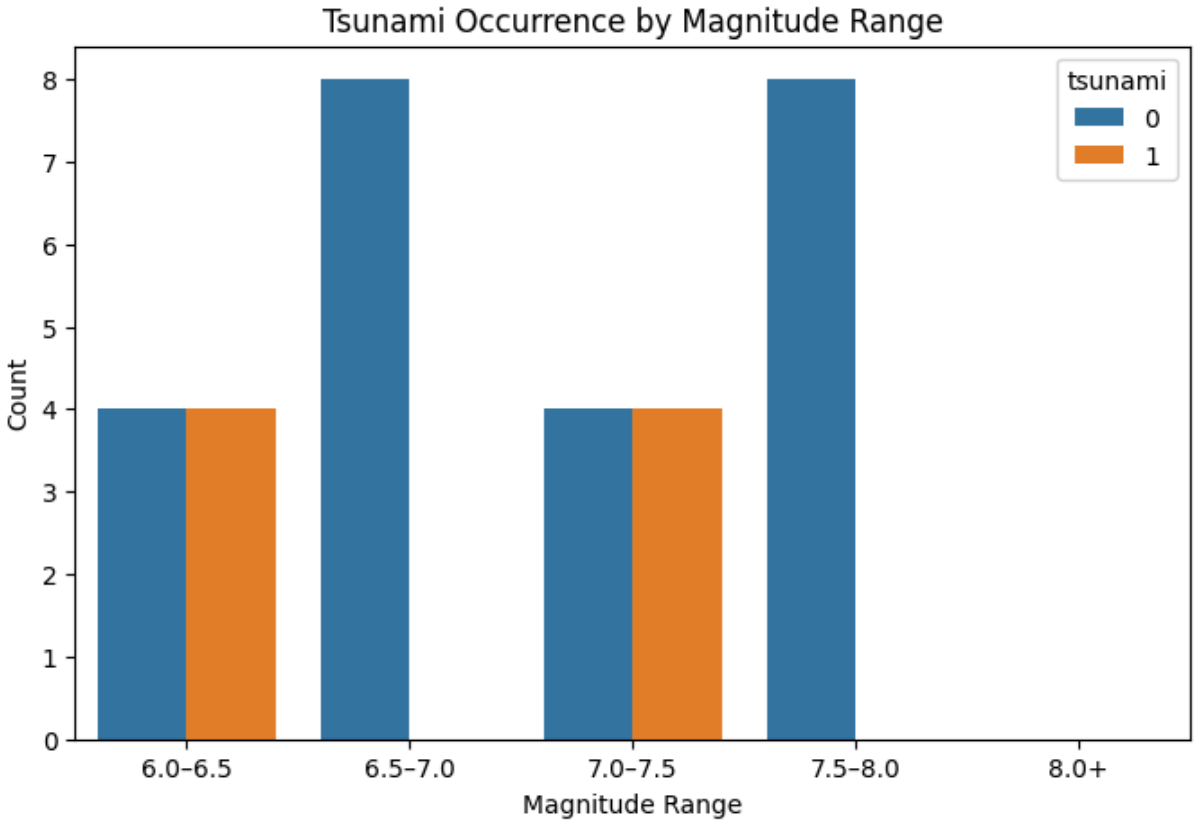
	magnitude	depth
count	8.0	8.000000
mean	8.0	38.250000
std	0.0	20.408332
min	8.0	12.000000
25%	8.0	22.500000
50%	8.0	40.000000
75%	8.0	54.000000
max	8.0	68.000000

In [24]:
```
#Correlation Heatmap

plt.figure()
sns.heatmap(df[['magnitude','depth','tsunami']].corr(),annot=True)
plt.title("Correlation Heatmap")
plt.show()
```



In [25]:
```
# Magnitude Range vs Tsunami Occurrence

df["Magnitude_Range"] = pd.cut(
    df["magnitude"],
    bins=[6.0, 6.5, 7.0, 7.5, 8.0, 9.5],
    labels=["6.0–6.5", "6.5–7.0", "7.0–7.5", "7.5–8.0", "8.0+"]
```

```
)
plt.figure(figsize=(8,5))
sns.countplot(x="Magnitude_Range", hue="tsunami", data=df)
plt.title("Tsunami Occurrence by Magnitude Range")
plt.xlabel("Magnitude Range")
plt.ylabel("Count")
plt.show()
```



In [ ]: