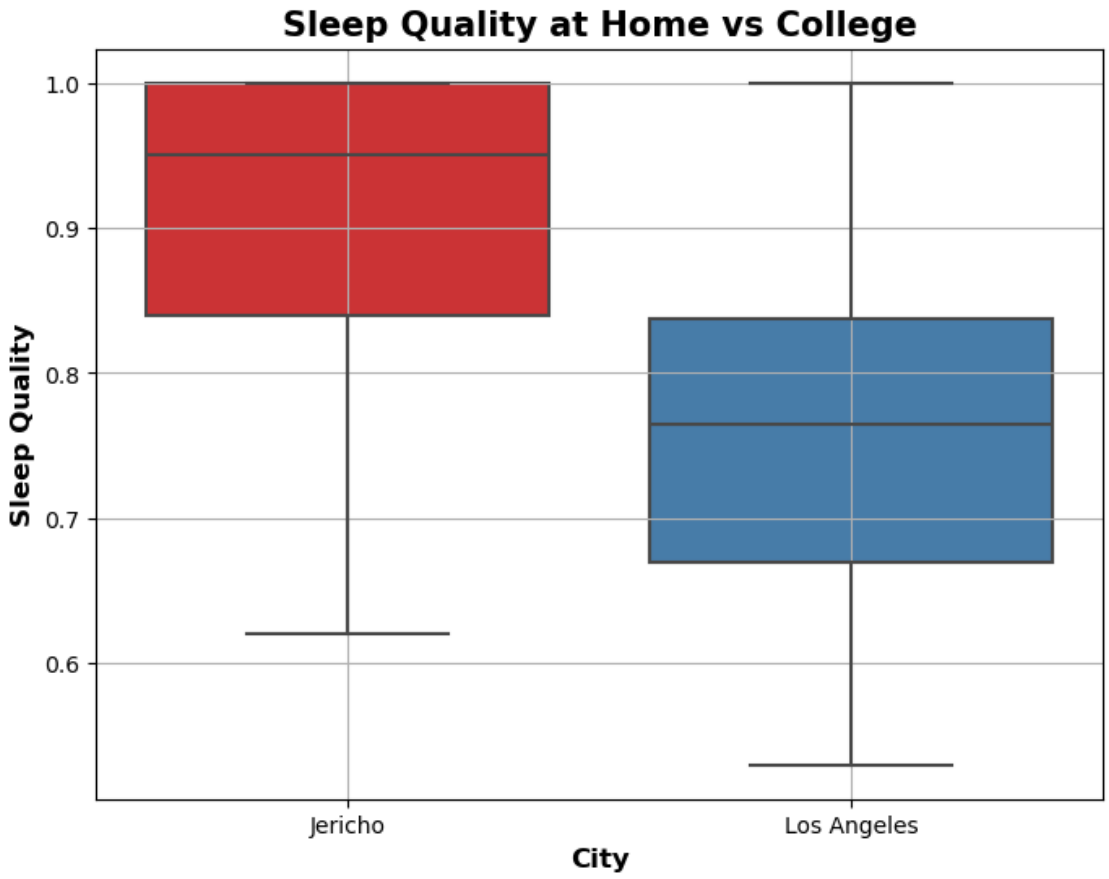
Sleep_Cycle_Visualizations

July 24, 2024

Boxplot of Sleep Quality at Home vs College

[3]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from scipy.stats import spearmanr

data = pd.read_csv("clean_sleepdata.csv", header = 0)

#Plot boxplot using python libraries
plt.figure(figsize=(8, 6))
sns.boxplot(x='City', y='Sleep Quality', data = data, palette='Set1')

#Add Labels
plt.title('Sleep Quality at Home vs College', fontsize = 15, fontweight =␣
↪'bold')
plt.xlabel('City', fontsize = 12, fontweight = 'bold')
plt.ylabel('Sleep Quality', fontsize = 12, fontweight = 'bold')
plt.grid(True)
```



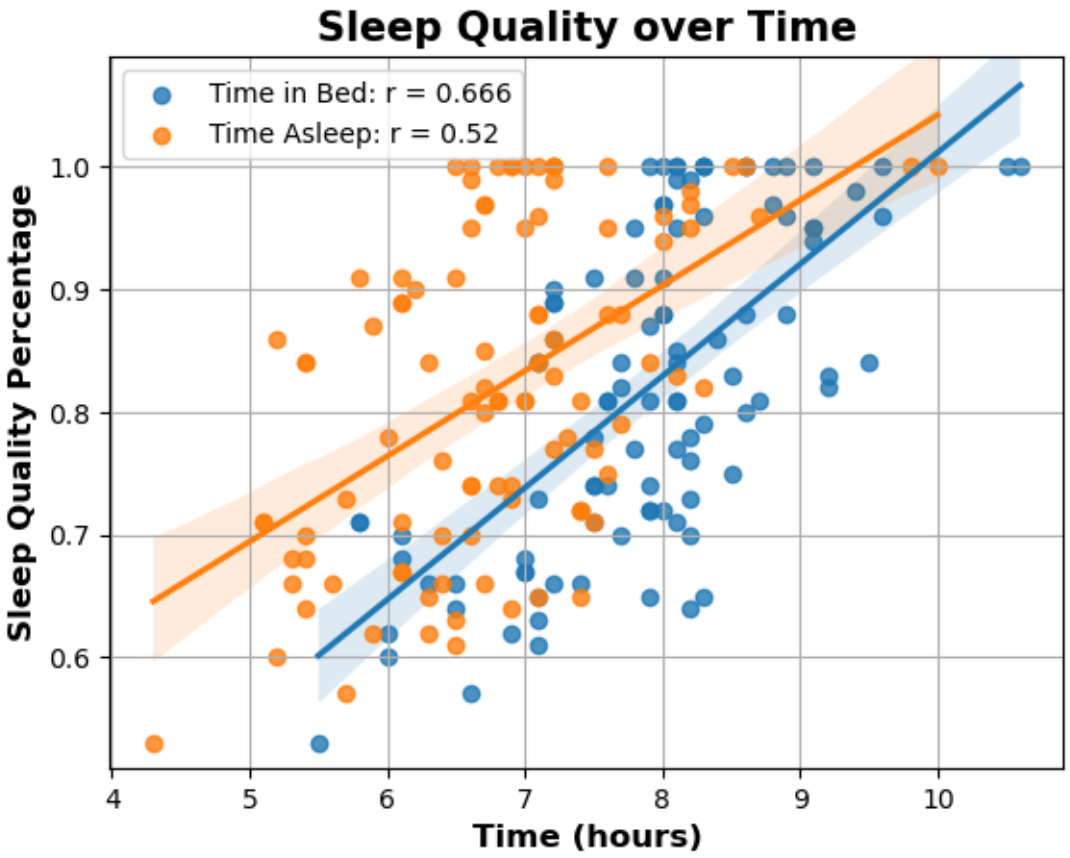
Scatterplot with sleep quality vs time in bed and time asleep

Calculated r values, spearman rank correlation and p-values between variables

[5]:
```
#Calculate Spearman Rank Correlation Coefficient and p-value to determine␣
 ↪strength of monotonic relationship[-1,1] and if statistically significant␣
 ↪(p<.05)
spearman_corr1, p_value1 = spearmanr(data['Time in bed (hrs)'], data['Sleep␣
 ↪Quality'])
print(f"Time in Bed Spearman's Rank Correlation Coefficient: {spearman_corr1.
 ↪round(3)}")
print(f"Time in Bed P-value: {p_value1}")
if p_value1 > .05:
    print("Not statistically significant")
else:
    print("Statistically significant")

spearman_corr2, p_value2 = spearmanr(data['Time asleep (hrs)'], data['Sleep␣
 ↪Quality'])
```

```
print(f"Time Asleep Spearman's Rank Correlation Coefficient: {spearman_corr2.
 ↪round(3)}")
print(f"Time Asleep P-value: {p_value2}")
if p_value2 > .05:
    print("Not statistically significant")
else:
    print("Statistically significant")

#Calculate correlation coefficient to determine strength of linear relationship
r_value1 = data['Time in bed (hrs)'].corr(data['Sleep Quality']).round(3)
r_value2 = data['Time asleep (hrs)'].corr(data['Sleep Quality']).round(3)

sns.regplot(x='Time in bed (hrs)', y='Sleep Quality', data= data, label= f'Time␣
 ↪in Bed: r = {r_value1}')
sns.regplot(x='Time asleep (hrs)', y='Sleep Quality', data= data, label= f'Time␣
 ↪Asleep: r = {r_value2}')

# Customize labels and title
plt.xlabel('Time (hours)', fontsize = 12, fontweight = 'bold')
plt.ylabel('Sleep Quality Percentage', fontsize = 12, fontweight = 'bold')
plt.title('Sleep Quality over Time', fontsize = 15, fontweight = 'bold')
plt.ylim(.51,1.09)
plt.legend()
plt.grid(True)
```

```
Time in Bed Spearman's Rank Correlation Coefficient: 0.644
Time in Bed P-value: 2.9201308033942853e-13
Statistically significant
Time Asleep Spearman's Rank Correlation Coefficient: 0.474
Time Asleep P-value: 4.935564626565741e-07
Statistically significant
```



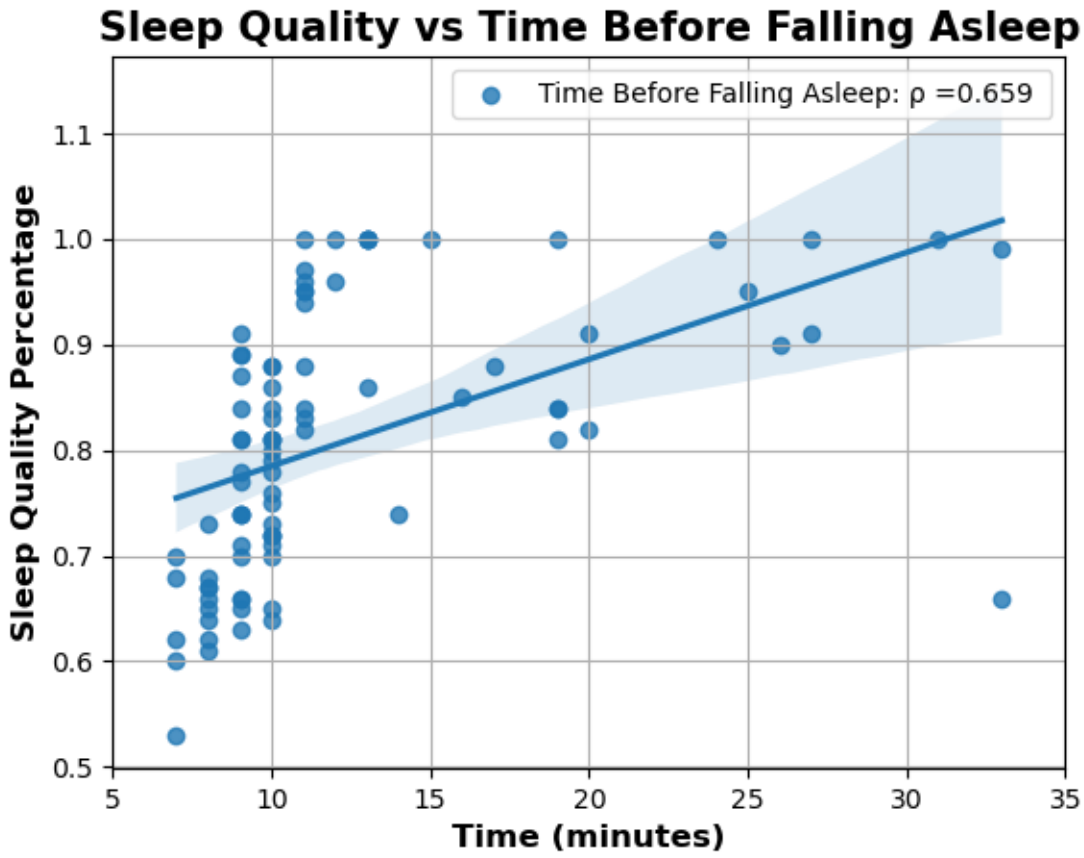
Scatterplot with sleep quality vs time to fall asleep

Calculate Spearman Rank Correlation Coefficient and p-value

[25]:
```
# Determine and remove outliers

Q1 = data['Time before sleep (mins)'].quantile(0.25)
Q3 = data['Time before sleep (mins)'].quantile(0.75)
IQR = Q3 - Q1
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR
no_outliers_data = data[(data['Time before sleep (mins)'] >= lower_bound) &␣
 ↪(data['Time before sleep (mins)'] <= upper_bound)]

#Calculate Spearman Rank Correlation Coefficient and p-value to determine␣
 ↪strength of monotonic relationship[-1,1] and if statistically significant␣
 ↪(p<.05)
spearman_corr, p_value = spearmanr(data['Time before sleep (mins)'],␣
 ↪data['Sleep Quality'])
```

```
print(f"Time Before Sleep Spearman's Rank Correlation Coefficient:   =␣
 ↪{spearman_corr.round(3)}")
print(f"Time Before Sleep P-value: {p_value}")
if p_value > .05:
    print("Not statistically significant")
else:
    print("Statistically significant")

# Scatterplot with sleep quality vs time to fall asleep
sns.regplot(x='Time before sleep (mins)', y='Sleep Quality', data=␣
 ↪no_outliers_data, label=f'Time Before Falling Asleep:   = {spearman_corr.
 ↪round(3)}')

# Customize labels and title
plt.xlabel('Time (minutes)', fontsize = 12, fontweight = 'bold')
plt.ylabel('Sleep Quality Percentage', fontsize = 12, fontweight = 'bold')
plt.title('Sleep Quality vs Time Before Falling Asleep', fontsize = 15,␣
 ↪fontweight = 'bold')
plt.legend()
plt.xlim(5,35)
plt.grid(True)
```

```
Time Before Sleep Spearman's Rank Correlation Coefficient: 0.659
Time Before Sleep P-value: 5.2734872114575003e-14
Statistically significant
```



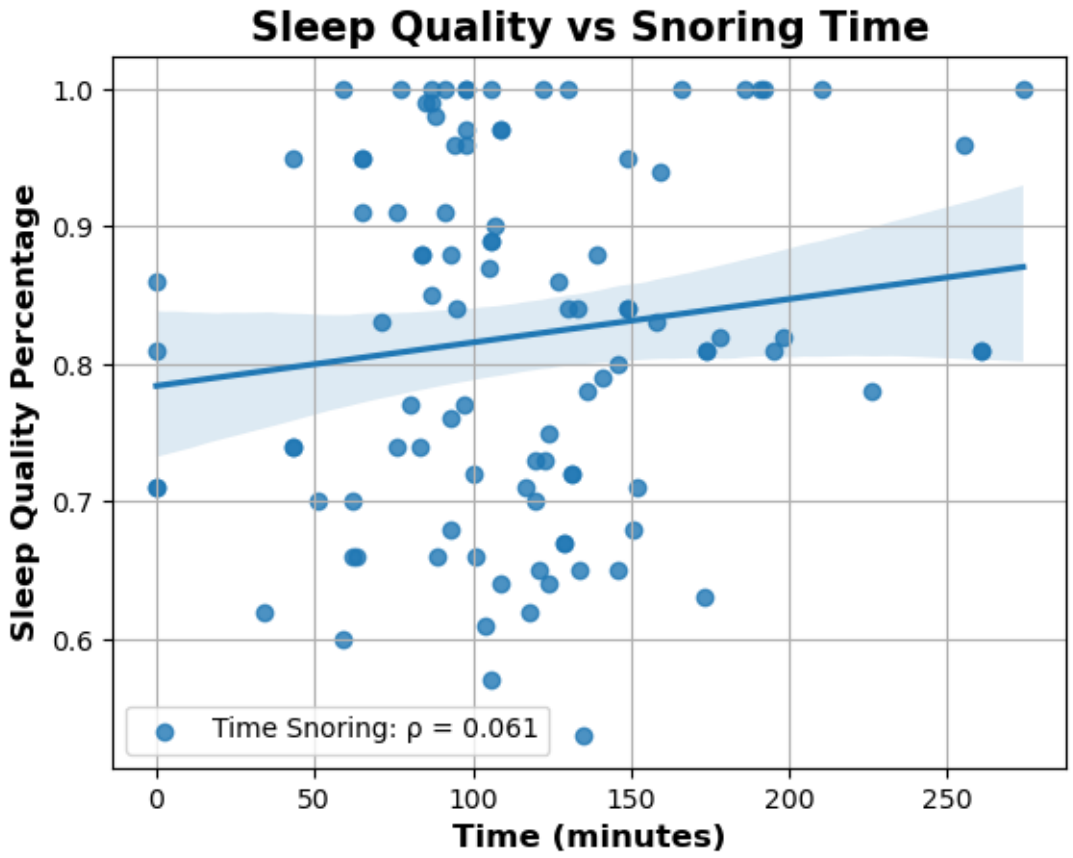
Scatterplot with sleep quality vs time snoring

Calculate Spearman Rank Correlation Coefficient and p-value

[26]:
```
#Calculate Spearman Rank Correlation Coefficient and p-value to determine␣
 ↪strength of monotonic relationship[-1,1] and if statistically significant␣
 ↪(p<.05)
spearman_corr, p_value = spearmanr(data['Snore time (mins)'], data['Sleep␣
 ↪Quality'])
print(f"Time Before Sleep Spearman's Rank Correlation Coefficient:  =␣
 ↪{spearman_corr.round(3)}")
print(f"Time Before Sleep P-value: {p_value}")
if p_value > .05:
    print("Not statistically significant")
else:
    print("Statistically significant")

# Scatterplot with sleep quality vs time snoring
sns.regplot(x='Snore time (mins)', y='Sleep Quality', data= data, label=f'Time␣
 ↪Snoring:  = {spearman_corr.round(3)}')
```

```
plt.xlabel('Time (minutes)', fontsize = 12, fontweight = 'bold')
plt.ylabel('Sleep Quality Percentage', fontsize = 12, fontweight = 'bold')
plt.title('Sleep Quality vs Snoring Time', fontsize = 15, fontweight = 'bold')
plt.legend()
plt.grid(True)
```

```
Time Before Sleep Spearman's Rank Correlation Coefficient:   = 0.061
Time Before Sleep P-value: 0.544468010334943
Not statistically significant
```



Barplot for Sleep Quality vs Steps

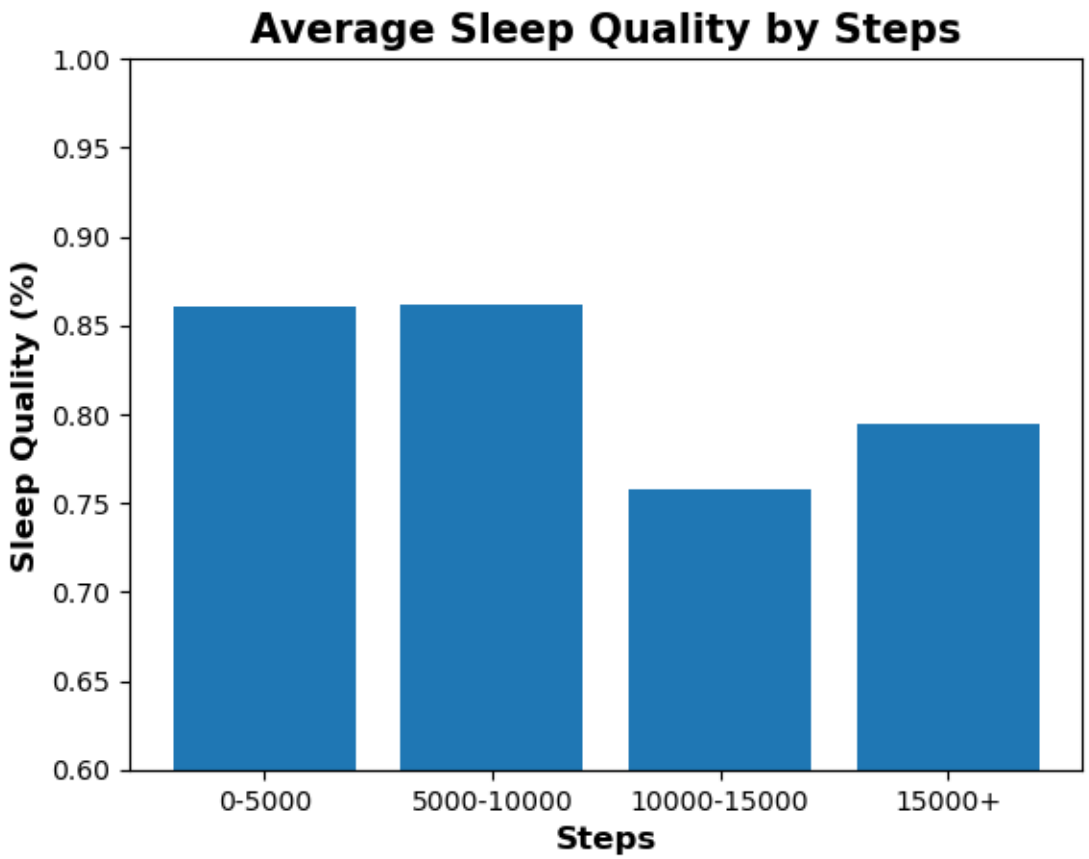
Calculate Spearman Rank Correlation Coefficient and p-value

[4]:
```
#Calculate Spearman Rank Correlation Coefficient and p-value to determine␣
↪strength of monotonic relationship[-1,1] and if statistically significant␣
↪(p<.05)
spearman_corr, p_value = spearmanr(data['Steps'], data['Sleep Quality'])
print(f"Steps Spearman's Rank Correlation Coefficient:   = {spearman_corr.
↪round(3)}")
```

```
print(f"Steps P-value: {p_value}")
if p_value > .05:
    print("Not statistically significant")
else:
    print("Statistically significant")

# Define bins and compute mean sleep quality values
bins = [0, 5000, 10000, 15000, float('inf')]
labels = ['0-5000', '5000-10000', '10000-15000', '15000+']

data_steps = data.copy()  # Create a copy of df to avoid altering the original

#Cut the data into intervals and calculate mean sleep quality for each interval
data_steps['Step Range'] = pd.cut(data_steps['Steps'], bins=bins,␣
 ↪labels=labels, right=False)
mean_sleep_quality = data_steps.groupby('Step Range')['Sleep Quality'].mean()

#Barplot for Sleep Quality vs Steps
plt.bar(mean_sleep_quality.index, mean_sleep_quality.values)
plt.title('Average Sleep Quality by Steps', fontsize = 15, fontweight = 'bold')
plt.xlabel('Steps', fontsize = 12, fontweight = 'bold')
plt.ylabel('Sleep Quality (%)', fontsize = 12, fontweight = 'bold')
plt.ylim(.6,1)
plt.show()
```

```
Steps Spearman's Rank Correlation Coefficient:  = -0.299
Steps P-value: 0.002261288942736987
Statistically significant
```

```
/tmp/ipykernel_125/950935730.py:18: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  mean_sleep_quality = data_steps.groupby('Step Range')['Sleep Quality'].mean()
```



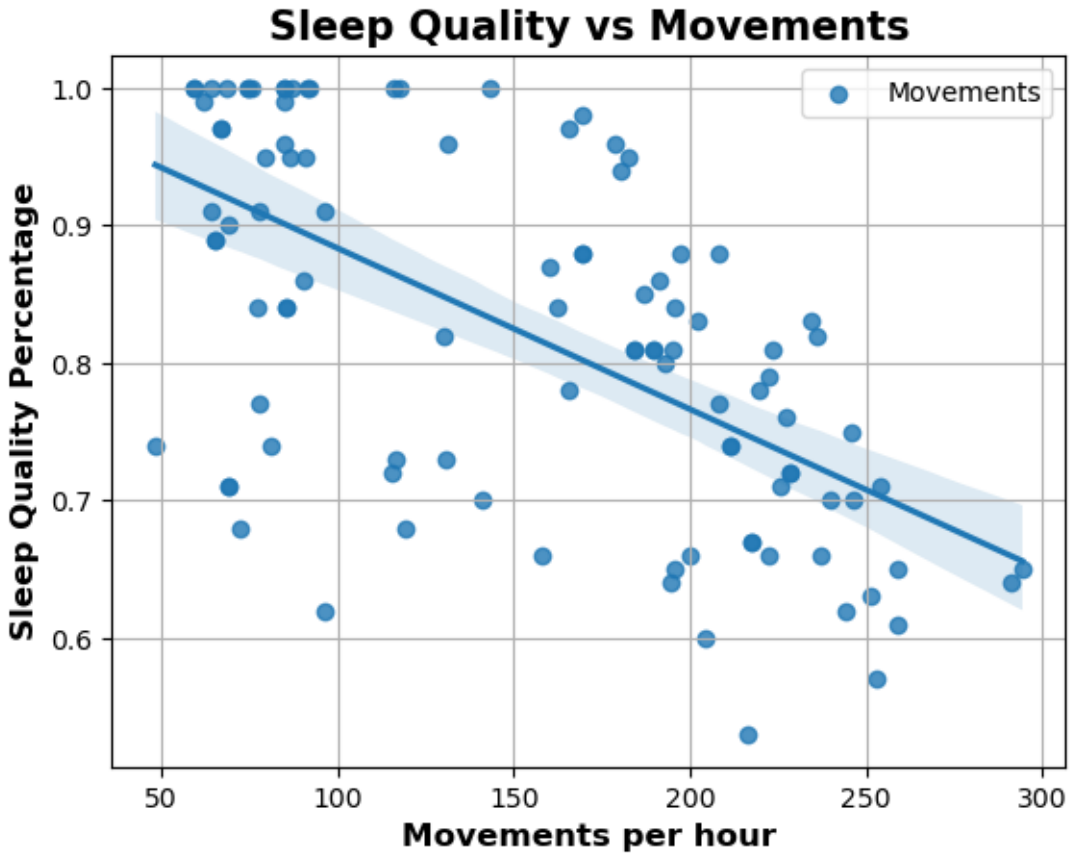
Scatterplot of Sleep Quality vs Movements per hour

Calculate Spearman Rank Correlation Coefficient and p-value

[30]:
```
#Calculate Spearman Rank Correlation Coefficient and p-value to determine␣
 ↪strength of monotonic relationship[-1,1] and if statistically significant␣
 ↪(p<.05)
spearman_corr, p_value = spearmanr(data['Movements per hour'], data['Sleep␣
 ↪Quality'])
print(f"Movements per hour Spearman's Rank Correlation Coefficient:  =␣
 ↪{spearman_corr.round(3)}")
print(f"Movements per hour P-value: {p_value}")
if p_value > .05:
    print("Not statistically significant")
else:
    print("Statistically significant")

#Scatterplot of Sleep Quality vs Movements per hour
```

```
sns.regplot(x='Movements per hour', y='Sleep Quality', data= data,␣
 ↪label='Movements')

plt.xlabel('Movements per hour', fontsize = 12, fontweight = 'bold')
plt.ylabel('Sleep Quality Percentage', fontsize = 12, fontweight = 'bold')
plt.title('Sleep Quality vs Movements', fontsize = 15, fontweight = 'bold')
plt.legend()
plt.grid(True)
```

```
Movements per hour Spearman's Rank Correlation Coefficient:   = -0.629
Movements per hour P-value: 1.5204762377291477e-12
Statistically significant
```



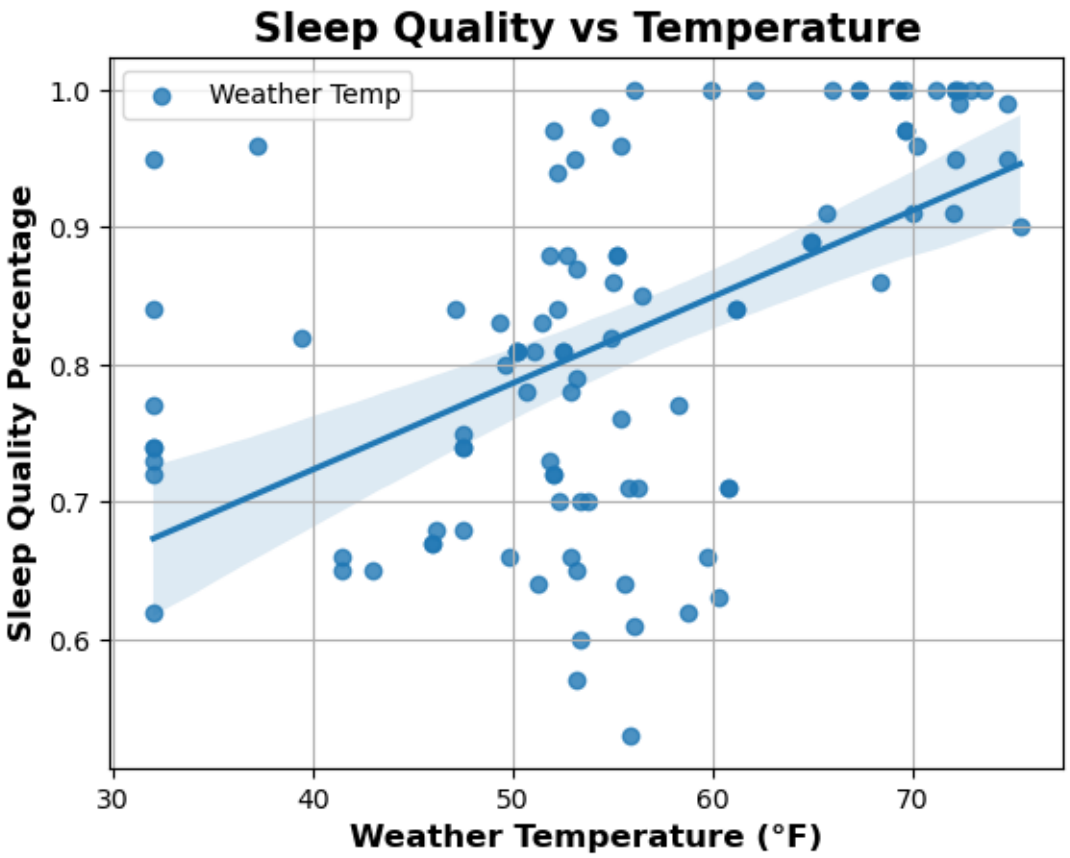
Scatterplot of sleep quality vs weather temperature

Calculate Spearman Rank Correlation Coefficient and p-value

[32]:
```
#Calculate Spearman Rank Correlation Coefficient and p-value to determine␣
 ↪strength of monotonic relationship[-1,1] and if statistically significant␣
 ↪(p<.05)
```

```
spearman_corr, p_value = spearmanr(data['Weather temperature (°F)'],␣
 ↪data['Sleep Quality'])
print(f"Weather Temperature Spearman's Rank Correlation Coefficient:  =␣
 ↪{spearman_corr.round(3)}")
print(f"Weather Temperature P-value: {p_value}")
if p_value > .05:
    print("Not statistically significant")
else:
    print("Statistically significant")

#Scatterplot of sleep quality vs weather temperature
sns.regplot(x='Weather temperature (°F)', y='Sleep Quality', data= data,␣
 ↪label='Weather Temp')
plt.xlabel('Weather Temperature (°F)', fontsize = 12, fontweight = 'bold')
plt.ylabel('Sleep Quality Percentage', fontsize = 12, fontweight = 'bold')
plt.title('Sleep Quality vs Temperature', fontsize = 15, fontweight = 'bold')
plt.legend()
plt.grid(True)
```

```
Weather Temperature Spearman's Rank Correlation Coefficient:  = 0.548
Weather Temperature P-value: 2.43509686786235e-09
Statistically significant
```

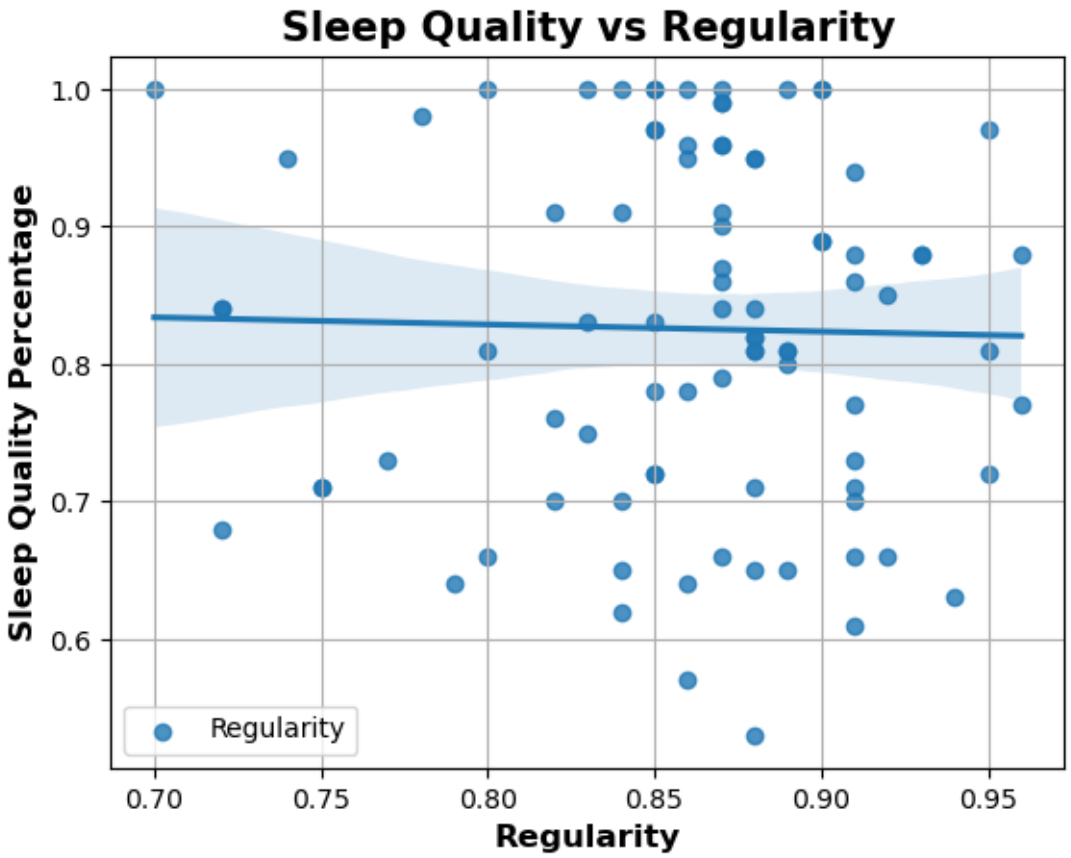


Scatterplot of sleep quality vs regularity

Calculate Spearman Rank Correlation Coefficient and p-value

[33]:
```
#Calculate Spearman Rank Correlation Coefficient and p-value to determine␣
 ↪strength of monotonic relationship[-1,1] and if statistically significant␣
 ↪(p<.05)
spearman_corr, p_value = spearmanr(data['Regularity'], data['Sleep Quality'])
print(f"Regularity Spearman's Rank Correlation Coefficient:  = {spearman_corr.
 ↪round(3)}")
print(f"Regularity P-value: {p_value}")
if p_value > .05:
    print("Not statistically significant")
else:
    print("Statistically significant")

#Remove outliers
Q1 = data['Regularity'].quantile(0.25)
Q3 = data['Regularity'].quantile(0.75)
IQR = Q3 - Q1
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR
no_outliers_data = data[(data['Regularity'] >= lower_bound) &␣
 ↪(data['Regularity'] <= upper_bound)]


#Scatterplot of sleep quality vs regularity
sns.regplot(x='Regularity', y='Sleep Quality', data= no_outliers_data,␣
 ↪label='Regularity')

plt.xlabel('Regularity', fontsize = 12, fontweight = 'bold')
plt.ylabel('Sleep Quality Percentage', fontsize = 12, fontweight = 'bold')
plt.title('Sleep Quality vs Regularity', fontsize = 15, fontweight = 'bold')
plt.legend()
plt.grid(True)
```

```
Regularity Spearman's Rank Correlation Coefficient:  = 0.013
Regularity P-value: 0.8989557938585949
Not statistically significant
```

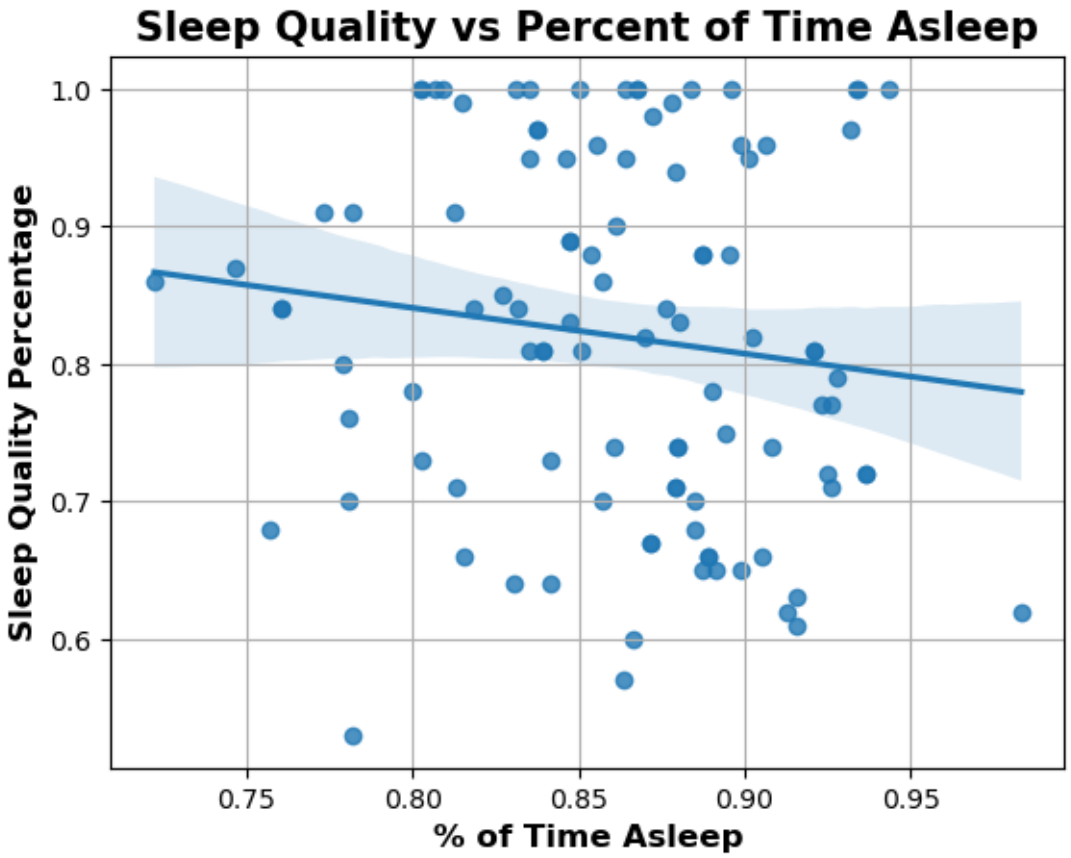


[ ]:
```
Scatterplot of Sleep Quality vs Percent of Time in Bed actually Asleep

Calculate Spearman Rank Correlation Coefficient and p-value
```

[35]:
```
#Add Statistic
data['Percent of time in bed actually asleep'] = data['Time asleep (hrs)'] /␣
 ↪data['Time in bed (hrs)']

#Calculate Spearman Rank Correlation Coefficient and p-value to determine␣
 ↪strength of monotonic relationship[-1,1] and if statistically significant␣
 ↪(p<.05)
spearman_corr, p_value = spearmanr(data['Percent of time in bed actually␣
 ↪asleep'], data['Sleep Quality'])
print(f"Percent of time in bed actually asleep Spearman's Rank Correlation␣
 ↪Coefficient:   = {spearman_corr.round(3)}")
print(f"Percent of time in bed actually asleep P-value: {p_value}")
if p_value > .05:
    print("Not statistically significant")
else:
```

```
    print("Statistically significant")

#Scatterplot of Sleep Quality vs Percent of Time in Bed actually Asleep
sns.regplot(x='Percent of time in bed actually asleep', y='Sleep Quality',␣
 ↪data= data)
plt.xlabel('% of Time Asleep', fontsize = 12, fontweight = 'bold')
plt.ylabel('Sleep Quality Percentage', fontsize = 12, fontweight = 'bold')
plt.title('Sleep Quality vs Percent of Time Asleep', fontsize = 15, fontweight␣
 ↪= 'bold')
plt.grid(True)
```

```
Percent of time in bed actually asleep Spearman's Rank Correlation Coefficient:
 = -0.165
Percent of time in bed actually asleep P-value: 0.09753637546605345
Not statistically significant
```

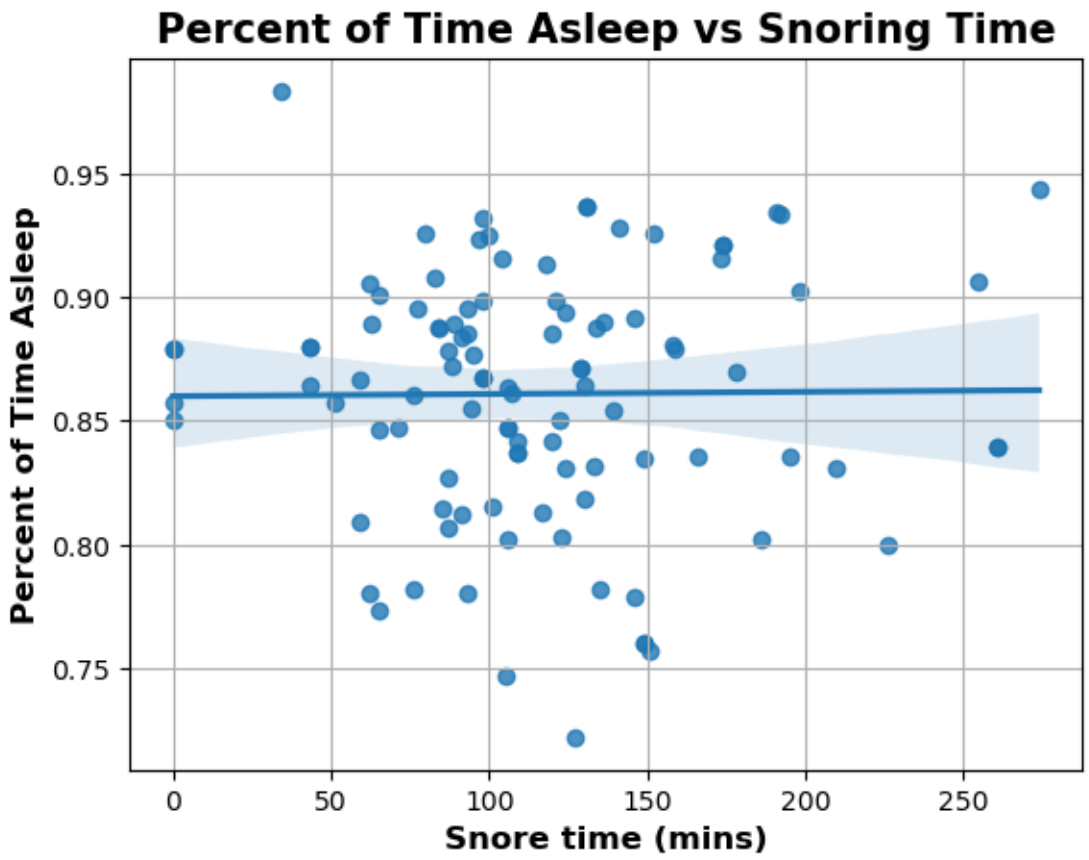


Scatterplot of Snoring vs Percent of Time in Bed actually Asleep

Calculate Spearman Rank Correlation Coefficient and p-value

[36]:
```
#Add Statistic
data['Percent of time in bed actually asleep'] = data['Time asleep (hrs)'] /␣
 ↪data['Time in bed (hrs)']

#Calculate Spearman Rank Correlation Coefficient and p-value to determine␣
 ↪strength of monotonic relationship[-1,1] and if statistically significant␣
 ↪(p<.05)
spearman_corr, p_value = spearmanr(data['Snore time (mins)'], data['Percent of␣
 ↪time in bed actually asleep'])
print(f"Spearman's Rank Correlation Coefficient:   = {spearman_corr.round(3)}")
print(f"P-value: {p_value}")
if p_value > .05:
    print("Not statistically significant")
else:
    print("Statistically significant")

#Scatterplot of Snoring vs Percent of Time in Bed actually Asleep
sns.regplot(x='Snore time (mins)', y='Percent of time in bed actually asleep',␣
 ↪data= data)
plt.xlabel('Snore time (mins)', fontsize = 12, fontweight = 'bold')
plt.ylabel('Percent of Time Asleep', fontsize = 12, fontweight = 'bold')
plt.title('Percent of Time Asleep vs Snoring Time', fontsize = 15, fontweight =␣
 ↪'bold')
plt.grid(True)
```

```
Spearman's Rank Correlation Coefficient:   = 0.003
P-value: 0.9780131578657392
Not statistically significant
```



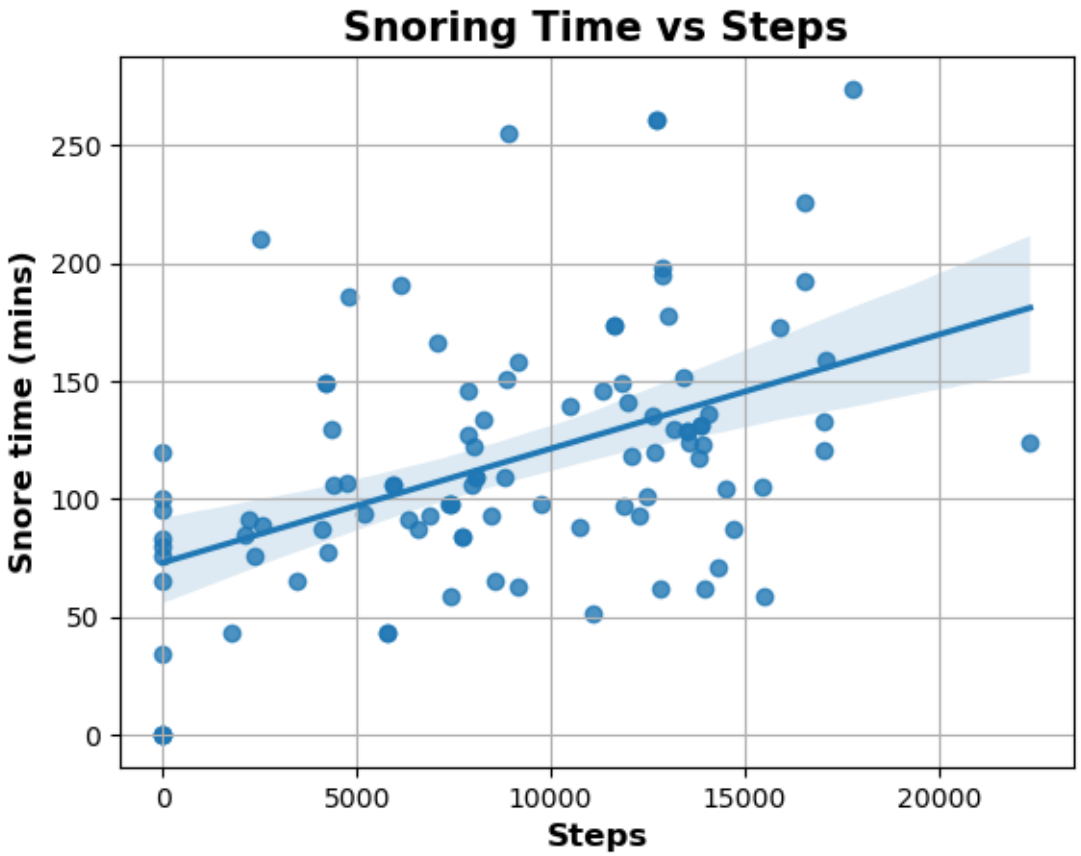
Scatterplot of Snoring vs Steps

Calculate Spearman Rank Correlation Coefficient and p-value

[37]:
```
#Calculate Spearman Rank Correlation Coefficient and p-value to determine␣
 ↪strength of monotonic relationship[-1,1] and if statistically significant␣
 ↪(p<.05)
spearman_corr, p_value = spearmanr(data['Snore time (mins)'], data['Steps'])
print(f"Spearman's Rank Correlation Coefficient:   = {spearman_corr.round(3)}")
print(f"P-value: {p_value}")
if p_value > .05:
    print("Not statistically significant")
else:
    print("Statistically significant")

#Scatterplot of Snoring vs Steps
sns.regplot(x='Steps', y='Snore time (mins)', data= data)
plt.xlabel('Steps', fontsize = 12, fontweight = 'bold')
plt.ylabel('Snore time (mins)', fontsize = 12, fontweight = 'bold')
plt.title('Snoring Time vs Steps', fontsize = 15, fontweight = 'bold')
```

```
plt.grid(True)
```

```
Spearman's Rank Correlation Coefficient:   = 0.465
P-value: 8.428002220138593e-07
Statistically significant
```



Scatterplot of Snoring vs Regularity

Calculate Spearman Rank Correlation Coefficient and p-value

[38]:
```
#Calculate Spearman Rank Correlation Coefficient and p-value to determine␣
 ↪strength of monotonic relationship[-1,1] and if statistically significant␣
 ↪(p<.05)
spearman_corr, p_value = spearmanr(data['Snore time (mins)'],␣
 ↪data['Regularity'])
print(f"Spearman's Rank Correlation Coefficient:   = {spearman_corr.round(3)}")
print(f"P-value: {p_value}")
if p_value > .05:
    print("Not statistically significant")
else:
```

```
    print("Statistically significant")

#Remove Outliers
Q1 = data['Regularity'].quantile(0.25)
Q3 = data['Regularity'].quantile(0.75)
IQR = Q3 - Q1
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR
no_outliers_data = data[(data['Regularity'] >= lower_bound) &␣
 ↪(data['Regularity'] <= upper_bound)]

#Scatterplot of Snoring vs Regularity
sns.regplot(x='Regularity', y='Snore time (mins)', data= no_outliers_data)
plt.xlabel('Regularity', fontsize = 12, fontweight = 'bold')
plt.ylabel('Snore time (mins)', fontsize = 12, fontweight = 'bold')
plt.title('Snoring Time vs Regularity', fontsize = 15, fontweight = 'bold')
plt.grid(True)
```

```
Spearman's Rank Correlation Coefficient:   = 0.11
P-value: 0.2691674537566523
Not statistically significant
```