Let's first import the packages

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

from sklearn.impute import SimpleImputer
from sklearn.preprocessing import OneHotEncoder, StandardScaler
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline
```

Import and display dataset's head

In [2]:
```
df = pd.read_csv('Exam_Score_Prediction.csv')
print(df.head())
```

```
   student_id  age  gender   course  study_hours  class_attendance  \
0      200.99   17    male  diploma         2.78              92.9   
1      200.99   23   other      bca         3.37              64.8   
2      200.99   22    male     b.sc         7.88              76.8   
3      200.99   20   other  diploma         0.67              48.4   
4      200.99   20  female  diploma         0.89              71.6   

  internet_access  sleep_hours sleep_quality   study_method facility_ratin
g  \
0             yes          7.4          poor       coaching             lo
w   
1             yes          4.6       average  online videos          mediu
m   
2             yes          8.5          poor       coaching            hig
h   
3             yes          5.8       average  online videos             lo
w   
4             yes          9.8          poor       coaching             lo
w   

  exam_difficulty  exam_score  
0            hard        58.9  
1        moderate        54.8  
2        moderate        90.3  
3        moderate        29.7  
4        moderate        43.7  
```

Display Dataset information

In [3]:
```
print(df.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20000 entries, 0 to 19999
Data columns (total 13 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   student_id        20000 non-null  float64
 1   age               20000 non-null  int64  
 2   gender            20000 non-null  object 
 3   course            20000 non-null  object 
 4   study_hours       20000 non-null  float64
 5   class_attendance  20000 non-null  float64
 6   internet_access   20000 non-null  object 
 7   sleep_hours       20000 non-null  float64
 8   sleep_quality     20000 non-null  object 
 9   study_method      20000 non-null  object 
 10  facility_rating   20000 non-null  object 
 11  exam_difficulty   20000 non-null  object 
 12  exam_score        20000 non-null  float64
dtypes: float64(5), int64(1), object(7)
memory usage: 2.0+ MB
None
```

Check if there is any missing values

In [4]:

```
print("\nMissing Values:\n", df.isna().sum())
df.describe(include='all')
```

```
Missing Values:
 student_id          0
age                 0
gender              0
course              0
study_hours         0
class_attendance    0
internet_access     0
sleep_hours         0
sleep_quality       0
study_method        0
facility_rating     0
exam_difficulty     0
exam_score          0
dtype: int64
```

Out[4]:

	student_id	age	gender	course	study_hours	class_attendance
count	20000.000000	20000.000000	20000	20000	20000.000000	20000.000000
unique	NaN	NaN	3	7	NaN	NaN
top	NaN	NaN	other	bca	NaN	NaN
freq	NaN	NaN	6726	2902	NaN	NaN
mean	10000.500000	20.473300	NaN	NaN	4.007604	70.017365
std	5770.211372	2.284458	NaN	NaN	2.308313	17.282262
min	200.990000	17.000000	NaN	NaN	0.080000	40.600000
25%	5000.750000	18.000000	NaN	NaN	2.000000	55.100000
50%	10000.500000	20.000000	NaN	NaN	4.040000	69.900000
75%	15000.250000	22.000000	NaN	NaN	6.000000	85.000000
max	19800.010000	24.000000	NaN	NaN	7.910000	99.400000

There is no any missing values, so we move further

Divide into categorial columns

In [5]:

```
numeric_cols = ["age", "study_hours", "class_attendance", "sleep_hours",
categorical_cols = [
    "gender", "course", "internet_access",
    "sleep_quality", "study_method",
    "facility_rating", "exam_difficulty"
]
```

If there is any missing values then fill with mean value

In [6]:

```
# Create imputers
num_imputer = SimpleImputer(strategy='mean')
cat_imputer = SimpleImputer(strategy='most_frequent')

df[numeric_cols] = num_imputer.fit_transform(df[numeric_cols])
df[categorical_cols] = cat_imputer.fit_transform(df[categorical_cols])

df.head()
```

Out[6]:

	student_id	age	gender	course	study_hours	class_attendance	internet_access
0	200.99	17.0	male	diploma	2.78	92.9	yes
1	200.99	23.0	other	bca	3.37	64.8	yes
2	200.99	22.0	male	b.sc	7.88	76.8	yes
3	200.99	20.0	other	diploma	0.67	48.4	yes
4	200.99	20.0	female	diploma	0.89	71.6	yes

Encode categorical features (One-Hot Encoding)

In [7]:

```
df_encoded = pd.get_dummies(df, columns=categorical_cols, drop_first=True
df_encoded.head()
```

Out[7]:

	student_id	age	study_hours	class_attendance	sleep_hours	exam_score	gender_r
0	200.99	17.0	2.78	92.9	7.4	58.9	
1	200.99	23.0	3.37	64.8	4.6	54.8	F
2	200.99	22.0	7.88	76.8	8.5	90.3	
3	200.99	20.0	0.67	48.4	5.8	29.7	F
4	200.99	20.0	0.89	71.6	9.8	43.7	F

5 rows × 25 columns

Feature Scaling (StandardScaler)

In [8]:

```
scaler = StandardScaler()
df_scaled = df_encoded.copy()

df_scaled[numeric_cols] = scaler.fit_transform(df_scaled[numeric_cols])

df_scaled.head()
```

Out[8]:

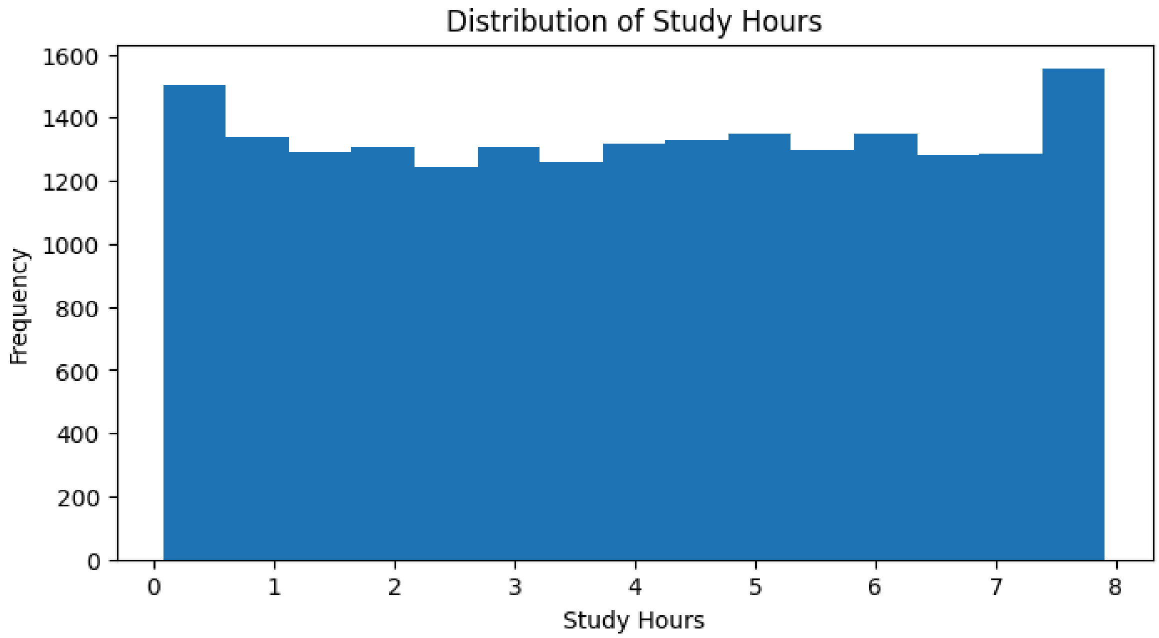
	student_id	age	study_hours	class_attendance	sleep_hours	exam_score	gen
0	200.99	-1.520442	-0.531832	1.324086	0.225999	-0.191095	
1	200.99	1.106067	-0.276227	-0.301899	-1.390586	-0.407934	
2	200.99	0.668315	1.677629	0.392472	0.861085	1.469576	
3	200.99	-0.207188	-1.445942	-1.250872	-0.697764	-1.735413	
4	200.99	-0.207188	-1.350632	0.091578	1.611643	-0.994987	

5 rows × 25 columns

Histogram of a feature

In [9]:

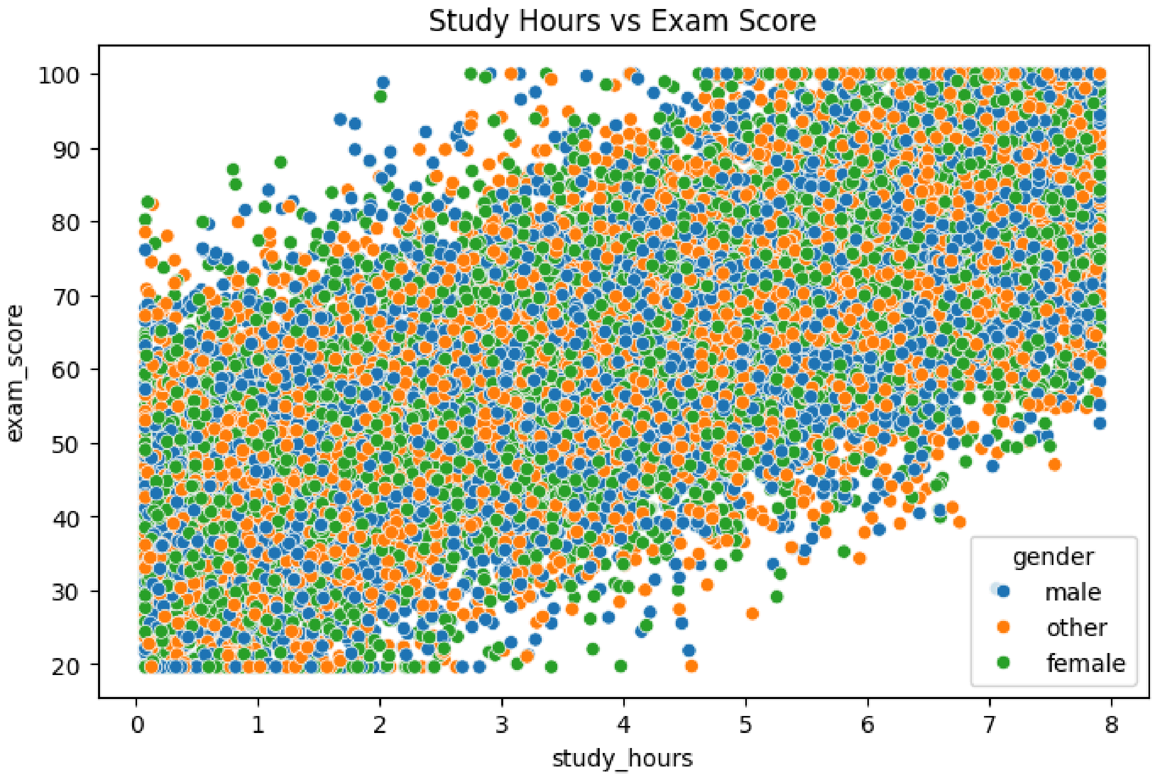
```
plt.figure(figsize=(8,4))
plt.hist(df['study_hours'], bins=15)
plt.title("Distribution of Study Hours")
plt.xlabel("Study Hours")
plt.ylabel("Frequency")
plt.show()
```



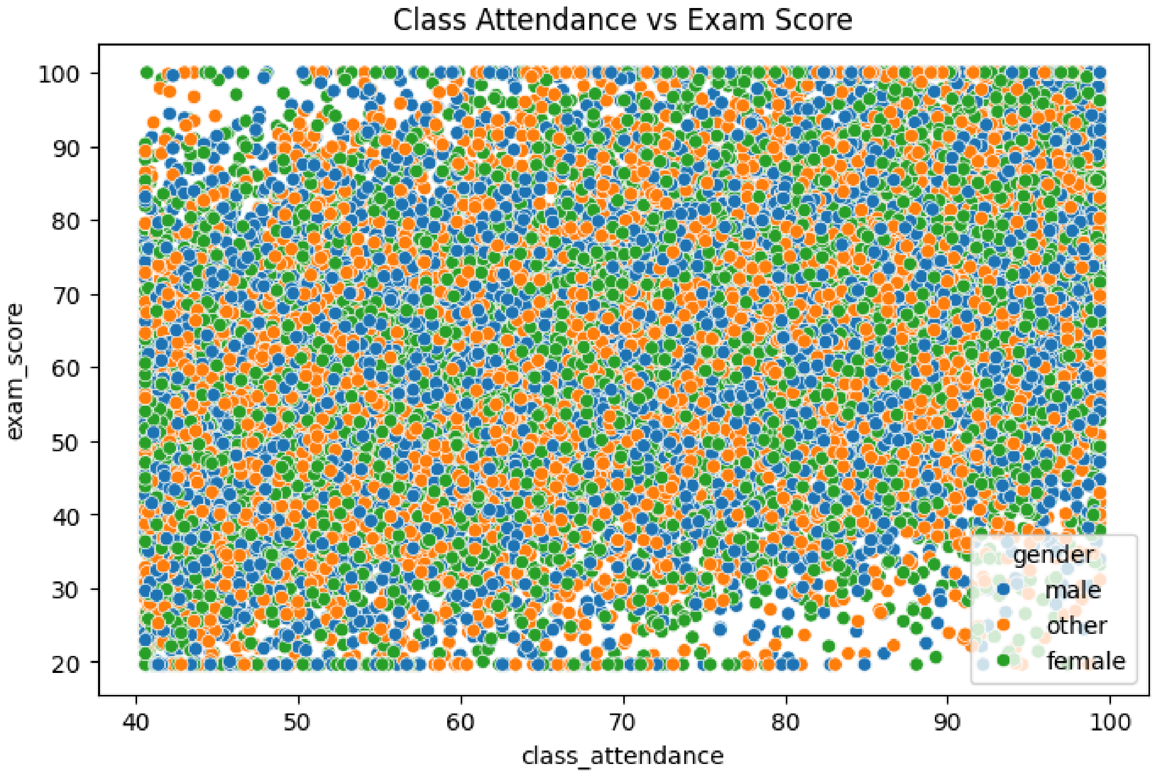
Scatter plot to see relationships

In [10]:

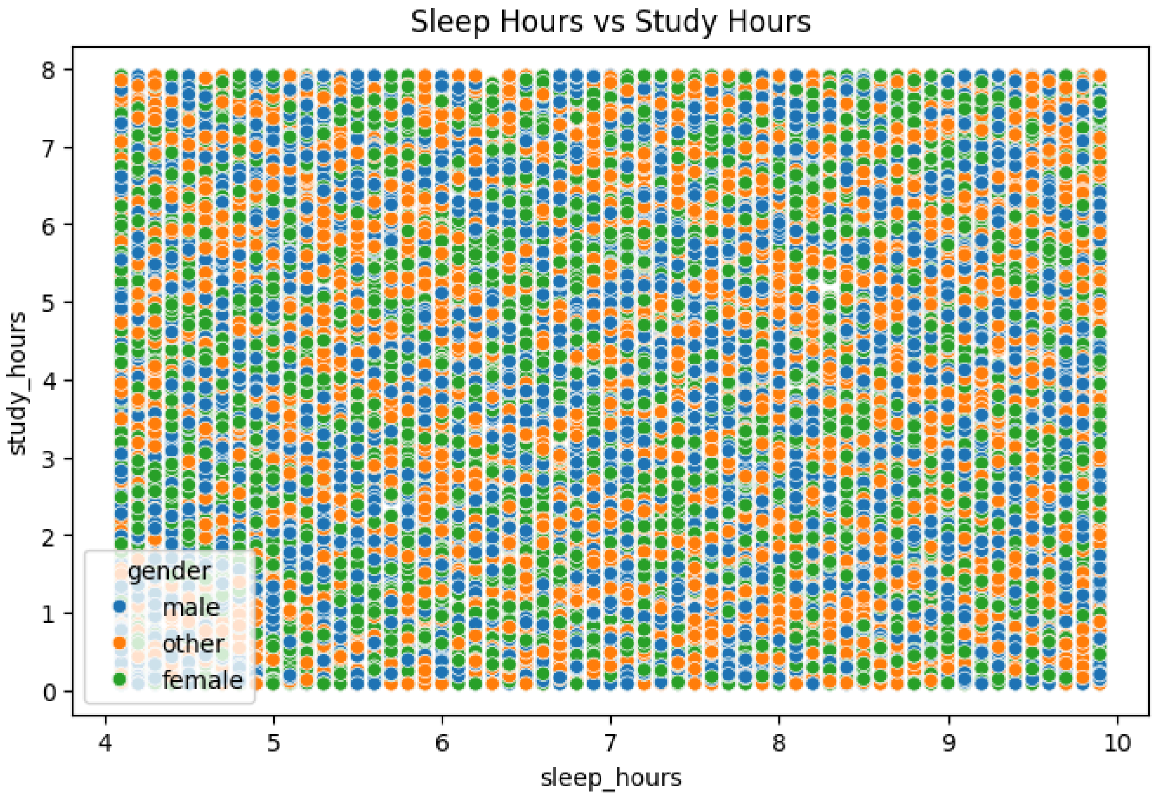
```
plt.figure(figsize=(8,5))
sns.scatterplot(x="study_hours", y="exam_score", hue="gender", data=df)
plt.title("Study Hours vs Exam Score")
plt.show()
```



In [11]:
```
plt.figure(figsize=(8,5))
sns.scatterplot(x="class_attendance", y="exam_score", hue="gender", data=
plt.title("Class Attendance vs Exam Score")
plt.show()
```

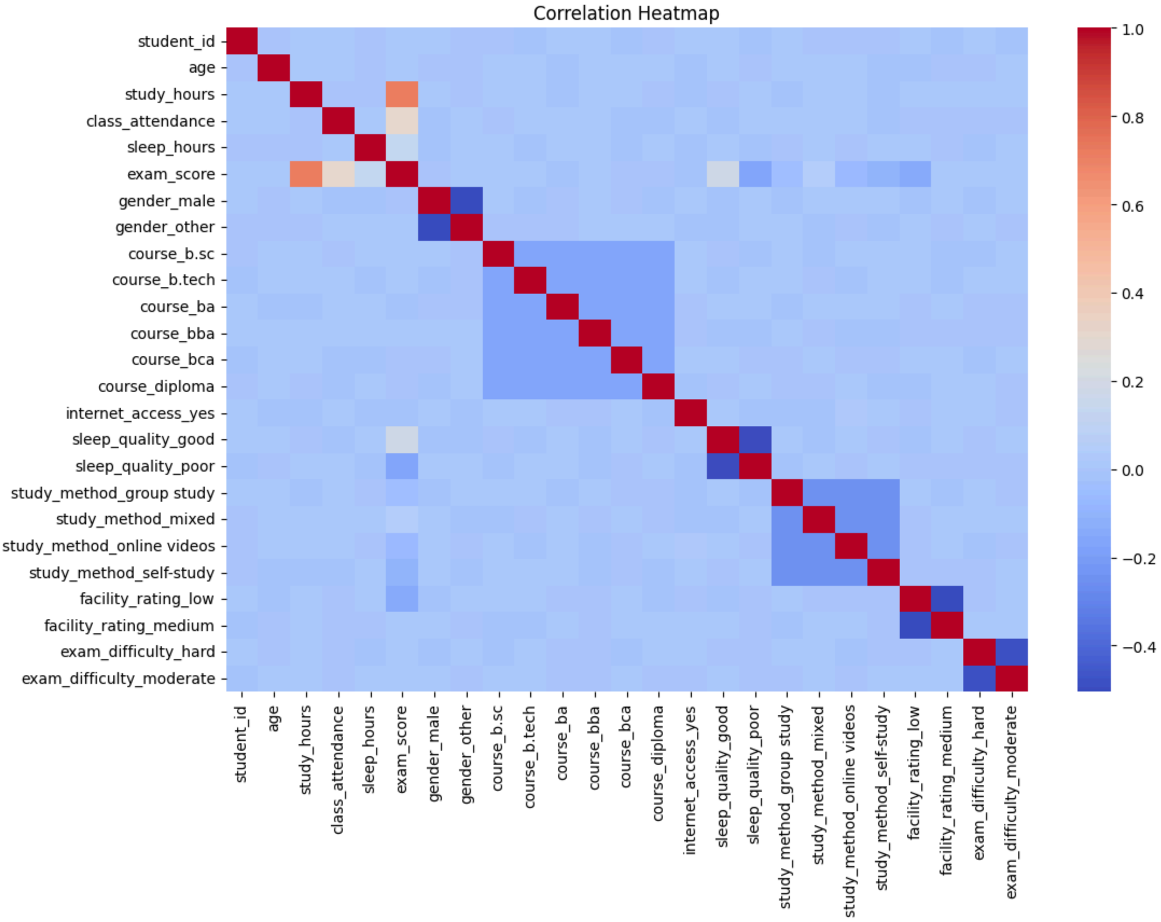


In [12]:
```
plt.figure(figsize=(8,5))
sns.scatterplot(x="sleep_hours", y="study_hours", hue="gender", data=df)
plt.title("Sleep Hours vs Study Hours")
plt.show()
```

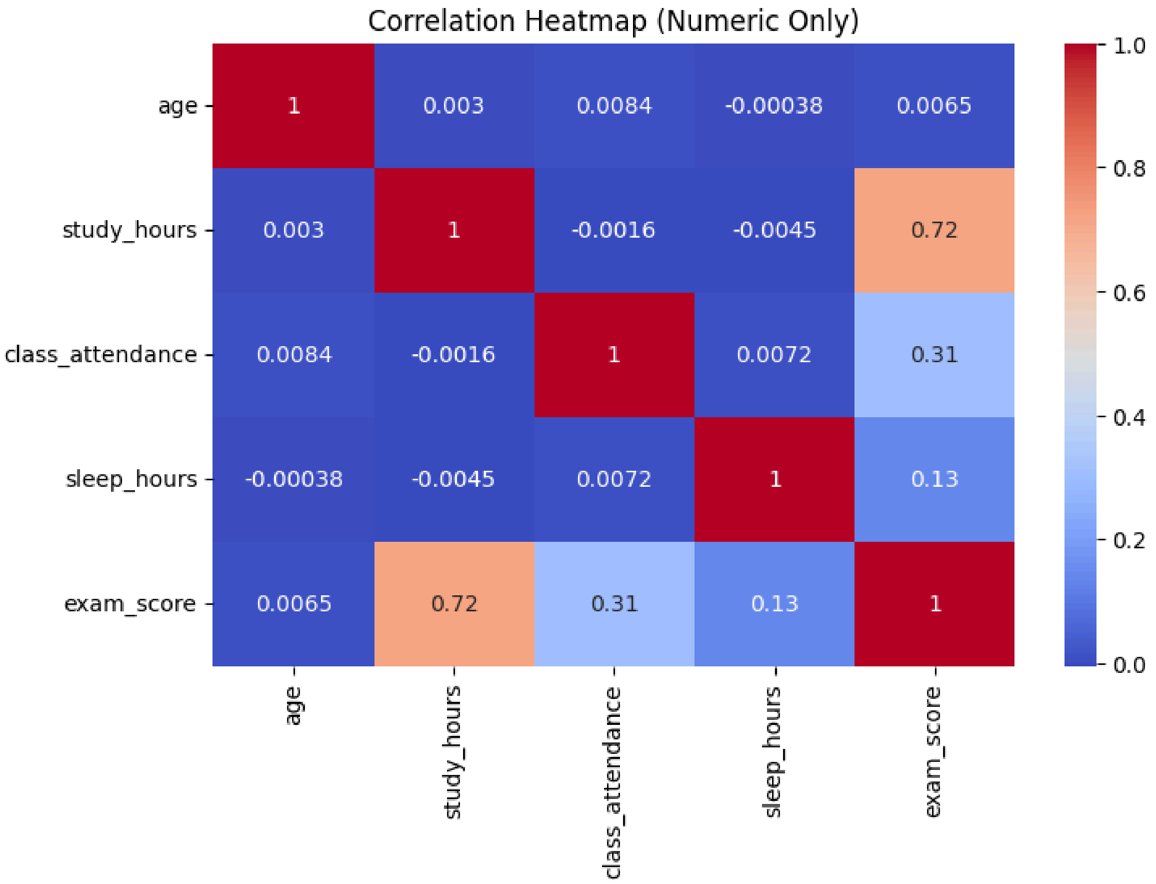


Correlation Heatmap

In [13]:
```
plt.figure(figsize=(12,8))
sns.heatmap(df_encoded.corr(), annot=False, cmap='coolwarm')
plt.title("Correlation Heatmap")
plt.show()
```



In [14]:
```python
plt.figure(figsize=(8,5))
sns.heatmap(df[numeric_cols].corr(), annot=True, cmap="coolwarm")
plt.title("Correlation Heatmap (Numeric Only)")
plt.show()
```



In [ ]: