Sprawozdanie Eksploracja Danych

Laboratorium 2 - 20.11.2024

Zbadanie funkcji estymującej jądra na danych generowanych losowo oraz przedstawienie wyników w formie graficznej.

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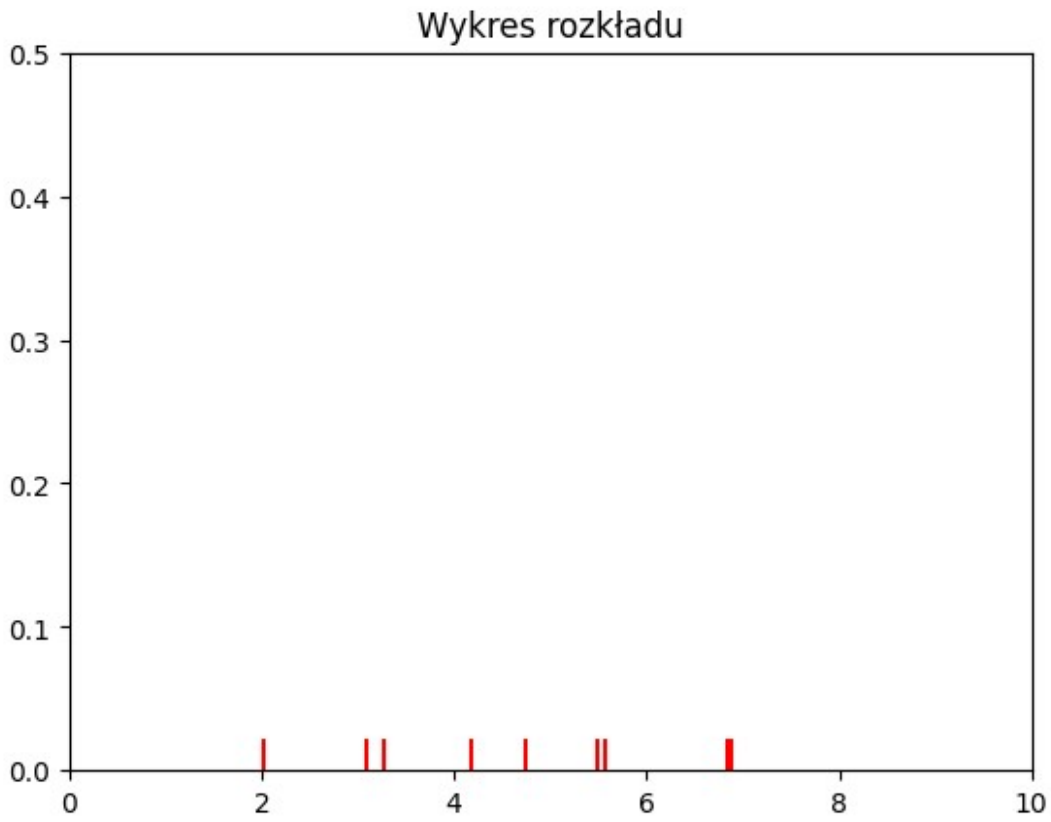
Cele sprawozdania:

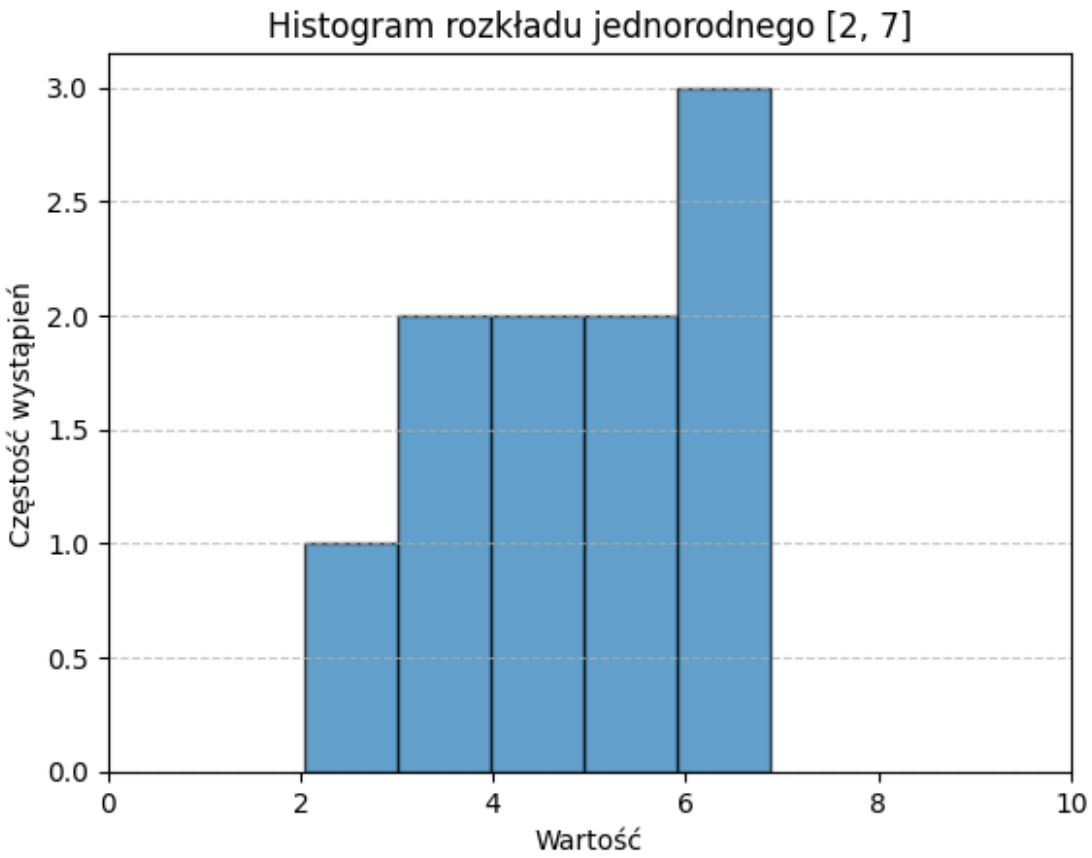
1. Sprawdzenie wpływu ilości wyygenerowanych próbek na ich graficzne przedstawienie na wykresie.
2. Zbadaie wpływu ilości przedziałów wykorzystanych do przedstawienia danych na histogramie danego rozkładu, na zgodność wykresu z teorią.
3. Zbadanie wpływu różnych parametrów na wartości funkcji estymatora jądra.

Wykorzystane biblioteki

```
import numpy as np
import matplotlib.pyplot as plt

import numpy as np
import matplotlib.pyplot as plt

np.random.seed(4)
sample_size = 10
uniform_sample = np.random.uniform(2, 7, sample_size)
y = [0 for _ in range(sample_size)]

plt.scatter(uniform_sample, y, marker='|', s=500, c='r')
plt.title('Wykres rozkładu')
plt.ylim(0, 0.5)
plt.xlim(0, 10)
plt.show()
```

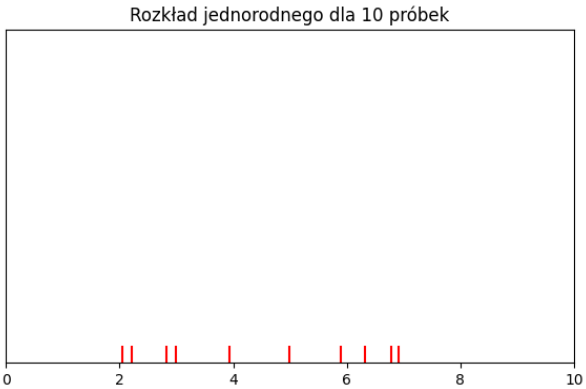



```
plt.hist(uniform_sample, bins=5, edgecolor='black', alpha=0.7)
plt.title('Histogram rozkładu jednorodnego [2, 7]')
plt.xlabel('Wartość')
plt.ylabel('Częstość wystąpień')
plt.xlim(0, 10)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```

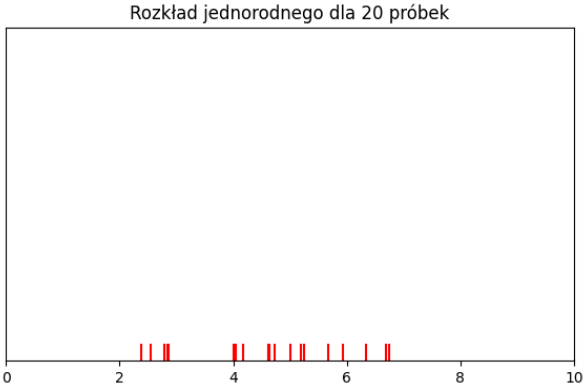



```
sample_sizes = [10, 20, 50, 100, 1000, 10000, 100000, 1000000]

fig, axes = plt.subplots(len(sample_sizes), 2, figsize=(12,
len(sample_sizes) * 4))

for idx, sample_size in enumerate(sample_sizes):
    uniform_sample = np.random.uniform(2, 7, sample_size)
    y = [0 for _ in range(sample_size)]

    axes[idx, 0].scatter(uniform_sample, y, marker='|', s=500, c='r')
    axes[idx, 0].set_title(f'Rozkład jednorodnego dla {sample_size}
próbek')
    axes[idx, 0].set_ylim(0, 0.5)
    axes[idx, 0].set_xlim(0, 10)
    axes[idx, 0].set_yticks([])

    axes[idx, 1].hist(uniform_sample, bins=10, edgecolor='black',
alpha=0.7, histtype='step', fill=False, density=True)
    axes[idx, 1].set_title(f'Histogram rozkładu jednorodnego dla
{sample_size} próbek')
    axes[idx, 1].set_xlabel('Wartość')
    axes[idx, 1].set_ylabel('Częstość wystąpień')
    axes[idx, 1].set_ylim(0, 0.5)
```

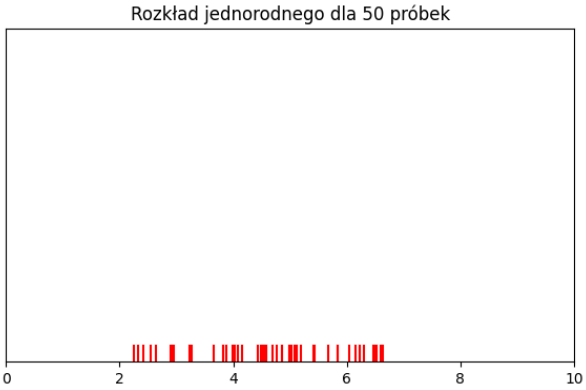
```
    axes[idx, 1].set_xlim(0, 10)
    axes[idx, 1].grid(True, linestyle='--', alpha=0.7)

plt.tight_layout()
plt.show()
```


Rozkład jednorodnego dla 10 próbek
0
2
4
6
8
10

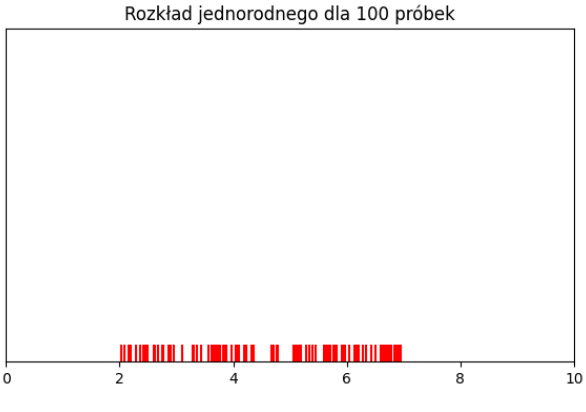

Histogram rozkładu jednorodnego dla 10 próbek
Częstość wystąpień
Wartość
0.0
0.1
0.2
0.3
0.4
0.5
0
2
4
6
8
10

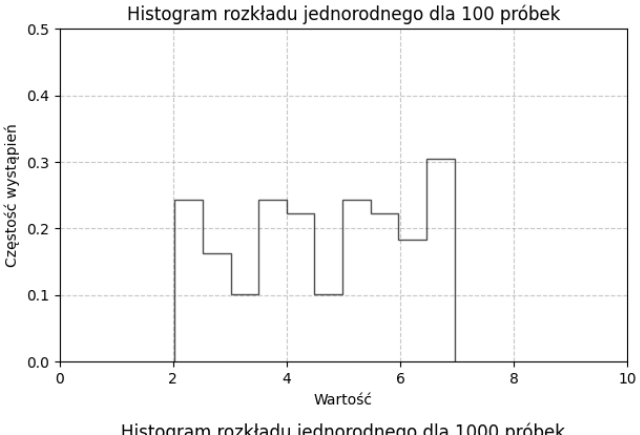

Rozkład jednorodnego dla 20 próbek
0
2
4
6
8
10

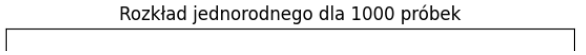

Histogram rozkładu jednorodnego dla 20 próbek
Częstość wystąpień
Wartość
0.0
0.1
0.2
0.3
0.4
0.5
0
2
4
6
8
10

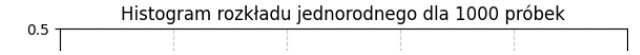

Rozkład jednorodnego dla 50 próbek
0
2
4
6
8
10


Histogram rozkładu jednorodnego dla 50 próbek
Częstość wystąpień
Wartość
0.0
0.1
0.2
0.3
0.4
0.5
0
2
4
6
8
10


Rozkład jednorodnego dla 100 próbek
0
2
4
6
8
10

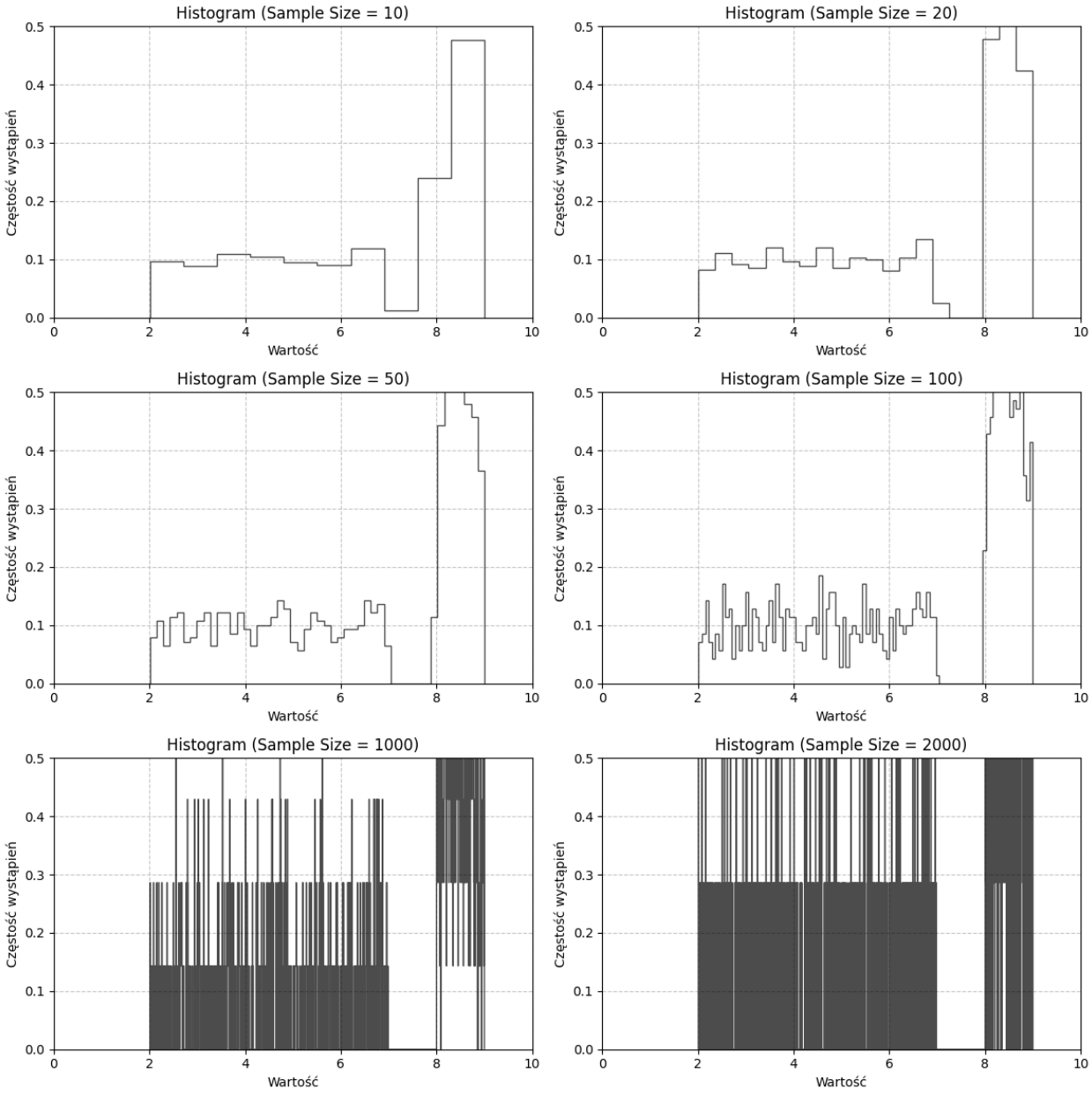

Histogram rozkładu jednorodnego dla 100 próbek
Częstość wystąpień
Wartość
0.0
0.1
0.2
0.3
0.4
0.5
0
2
4
6
8
10


Rozkład jednorodnego dla 1000 próbek


Histogram rozkładu jednorodnego dla 1000 próbek
0.5

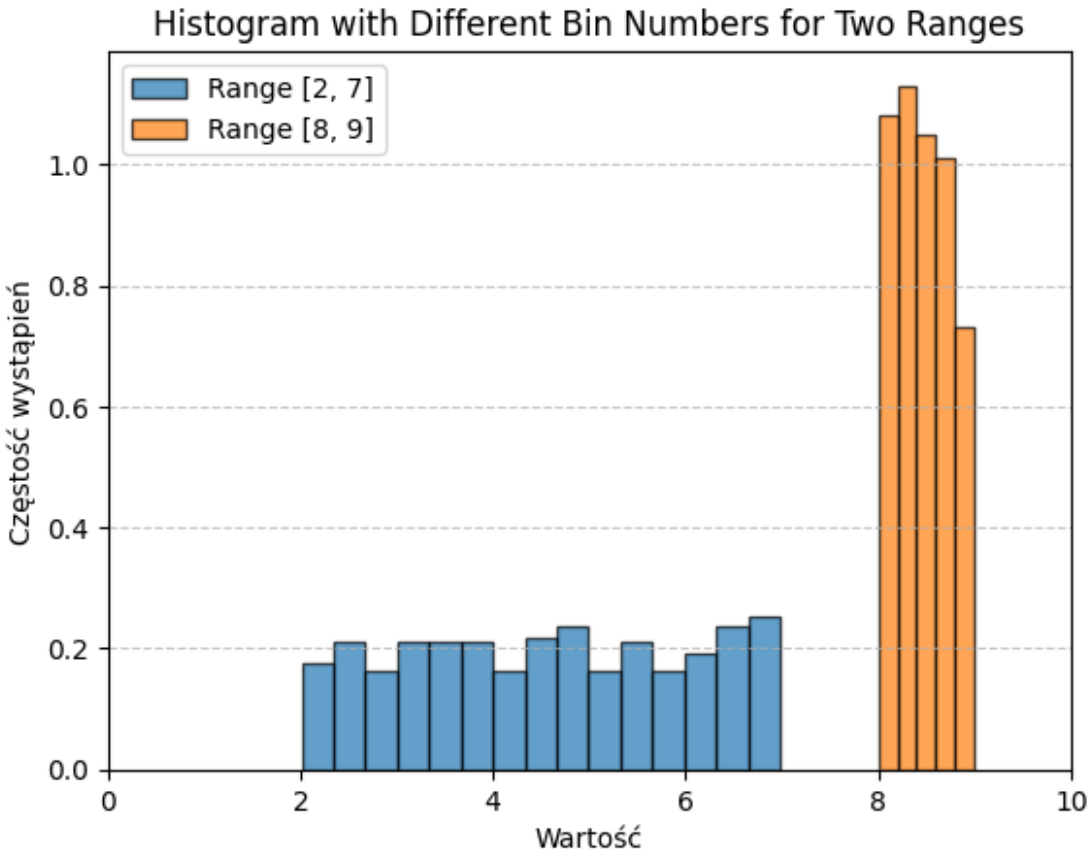
```
# sample_size = 1000
# bin_counts = [10, 20, 50, 100, 1000, 2000]

# fig, axes = plt.subplots(3, 2, figsize=(12, 12))

# uniform_sample = np.random.uniform(2, 7, sample_size)
# y = [0 for _ in range(sample_size)]

# for i, ax in enumerate(axes.flat):
#     ax.hist(uniform_sample, bins=bin_counts[i], edgecolor='black',
alpha=0.7, histtype='step', fill=False, density=True)
#     ax.set_title(f'Histogram (Sample Size = {bin_counts[i]})')
#     ax.set_xlabel('Value')
#     ax.set_ylabel('Frequency')
#     ax.set_ylim(0, 0.5)
#     ax.set_xlim(0, 10)
#     ax.grid(True, linestyle='--', alpha=0.7)

# # fig, axes = plt.subplots(3, 2, figsize=(12, 12))

# # # Loop through the axes and data samples to create plots
# # for i, ax in enumerate(axes.flat):
# #     ax.hist(data_samples[i], bins=5, edgecolor='black', alpha=0.7,
histtype='step', fill=False)
# #     ax.set_title(f'Plot {i + 1}')
# #     ax.set_xlabel('Value')
# #     ax.set_ylabel('Frequency')
# #     ax.grid(axis='y', linestyle='--', alpha=0.7)

# plt.tight_layout()
# plt.show()

sample_size = 1000
bin_counts = [10, 20, 50, 100, 1000, 2000]

fig, axes = plt.subplots(3, 2, figsize=(12, 12))

uniform_sample = np.random.uniform(2, 7, sample_size)

sample_1 = np.random.uniform(2, 7, sample_size // 2)
sample_2 = np.random.uniform(8, 9, sample_size // 2)

combined_sample = np.concatenate([sample_1, sample_2])

for i, ax in enumerate(axes.flat):
    ax.hist(combined_sample, bins=bin_counts[i], edgecolor='black',
alpha=0.7, histtype='step', fill=False, density=True)
    ax.set_title(f'Histogram (Sample Size = {bin_counts[i]})')
    ax.set_xlabel('Wartość')
    ax.set_ylabel('Częstość wystąpień')
    ax.set_ylim(0, 0.5)
```

```
    ax.set_xlim(0, 10)
    ax.grid(True, linestyle='--', alpha=0.7)


plt.tight_layout()
plt.show()
```



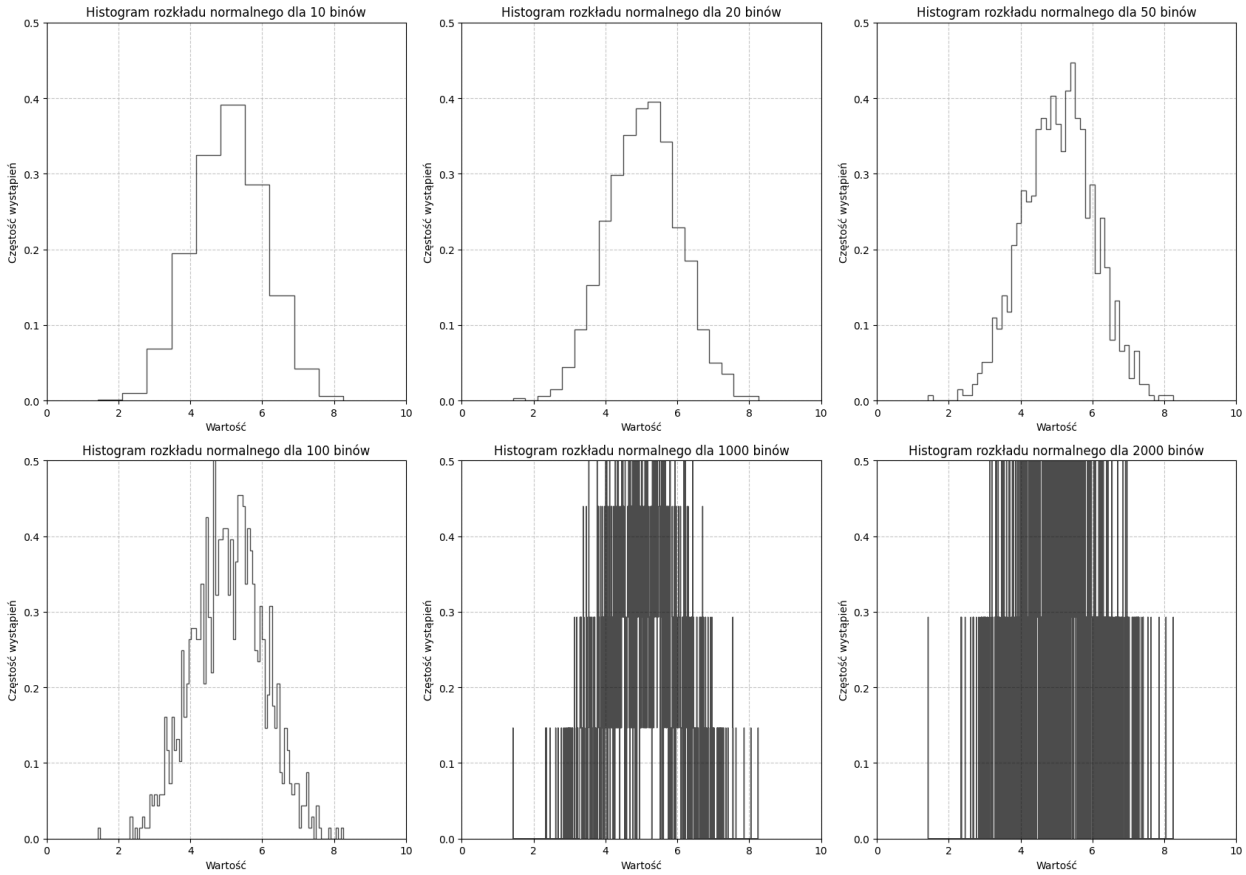

```
bins_range_1 = 15
bins_range_2 = 5

plt.hist(sample_1, bins=bins_range_1, edgecolor='black', alpha=0.7,
label='Range [2, 7]', density=True)
```

```
plt.hist(sample_2, bins=bins_range_2, edgecolor='black', alpha=0.7,
label='Range [8, 9]', density=True)

plt.title('Histogram with Different Bin Numbers for Two Ranges')
plt.xlabel('Wartość')
plt.ylabel('Częstość wystąpień')
plt.legend()
plt.xlim(0, 10)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```



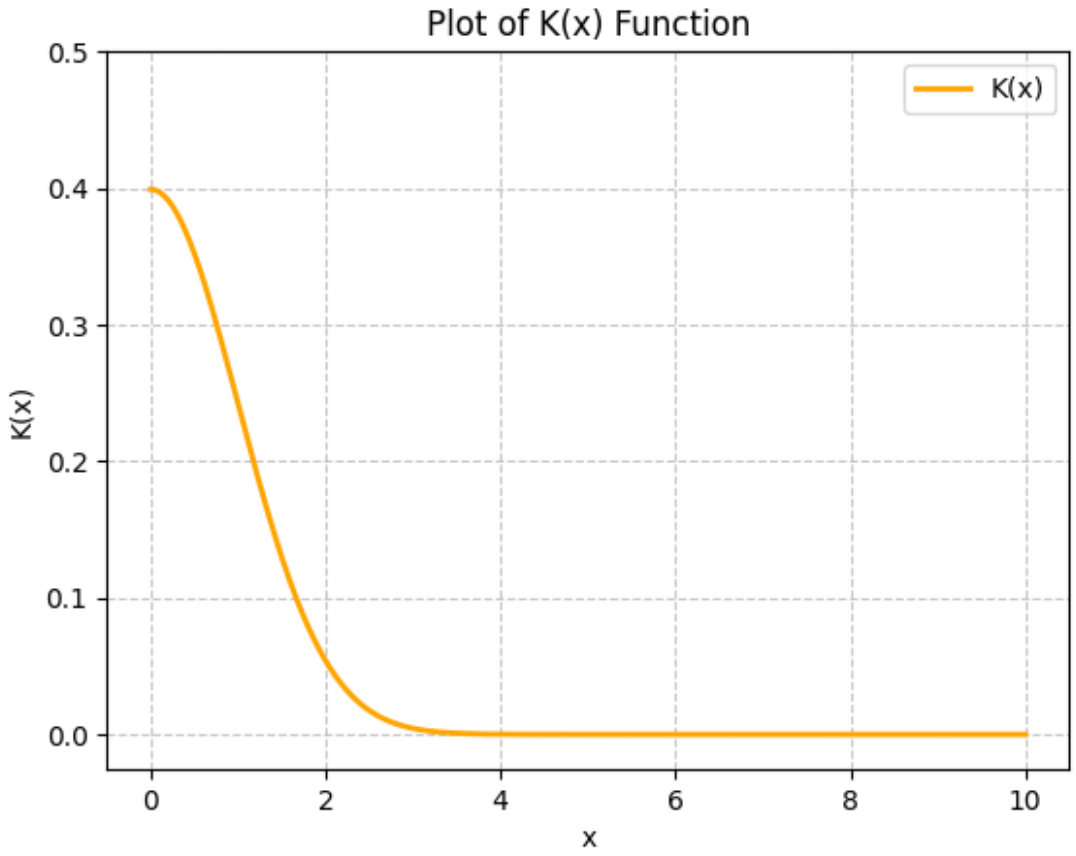

```
sample_size = 1000
bin_counts = [10, 20, 50, 100, 1000, 2000]

fig, axes = plt.subplots(2, 3, figsize=(17, 12))

normal_sample = np.random.normal(5, 1, sample_size)

for i, ax in enumerate(axes.flat):
    ax.hist(normal_sample, bins=bin_counts[i], edgecolor='black',
alpha=0.7, histtype='step', fill=False, density=True)
    ax.set_title(f'Histogram rozkładu normalnego dla {bin_counts[i]}
binów')
```

```
    ax.set_xlabel('Wartość')
    ax.set_ylabel('Częstość wystąpień')
    ax.set_ylim(0, 0.5)
    ax.set_xlim(0, 10)
    ax.grid(True, linestyle='--', alpha=0.7)

plt.tight_layout()
plt.show()
```



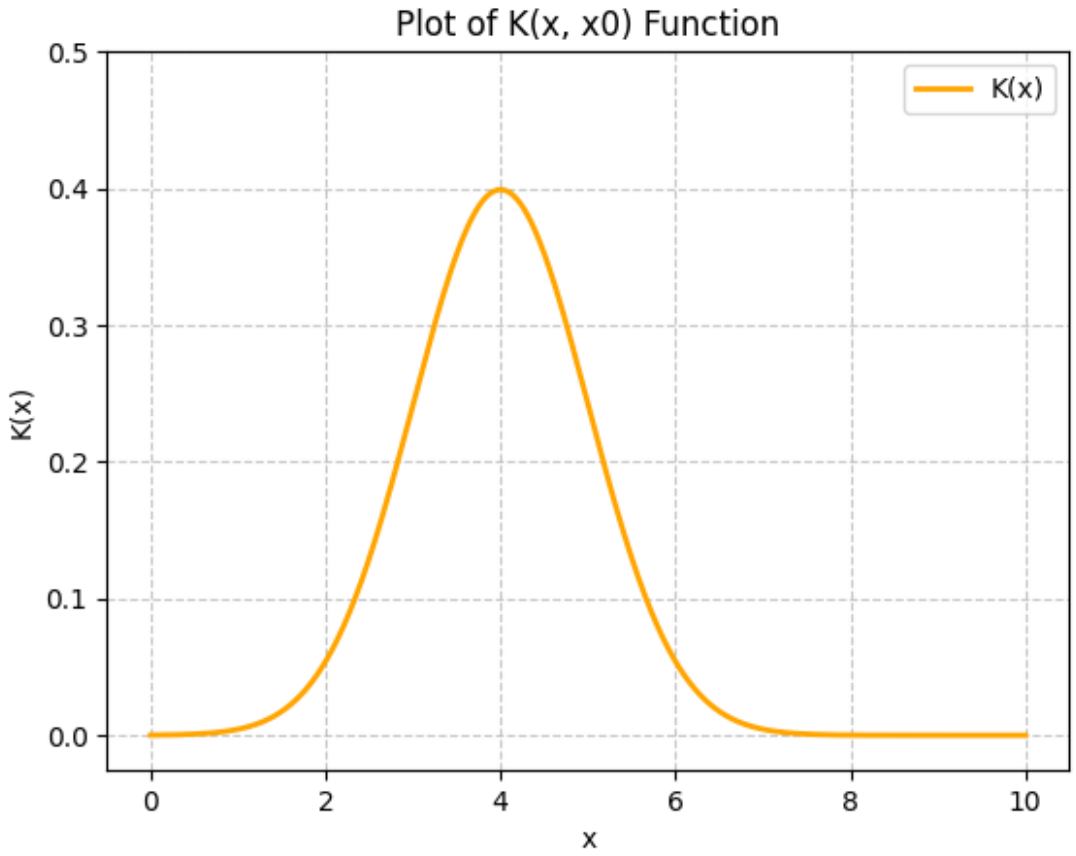

```
import math

def K(x):
    return 1. / math.sqrt(2 * math.pi) * math.exp(-x ** 2 / 2)

x_values = np.linspace(0, 10, 500)
y_values = [K(x) for x in x_values]

# Plot the function
plt.plot(x_values, y_values, label='K(x)', color='orange',
linewidth=2)
plt.title('Plot of K(x) Function')
plt.xlabel('x')
plt.ylabel('K(x)')
```

```
plt.grid(True, linestyle='--', alpha=0.7)
plt.xlim(- (10 * .05), 10.5)
plt.ylim(- (.5 * .05), 0.5)
plt.legend()
plt.show()
```



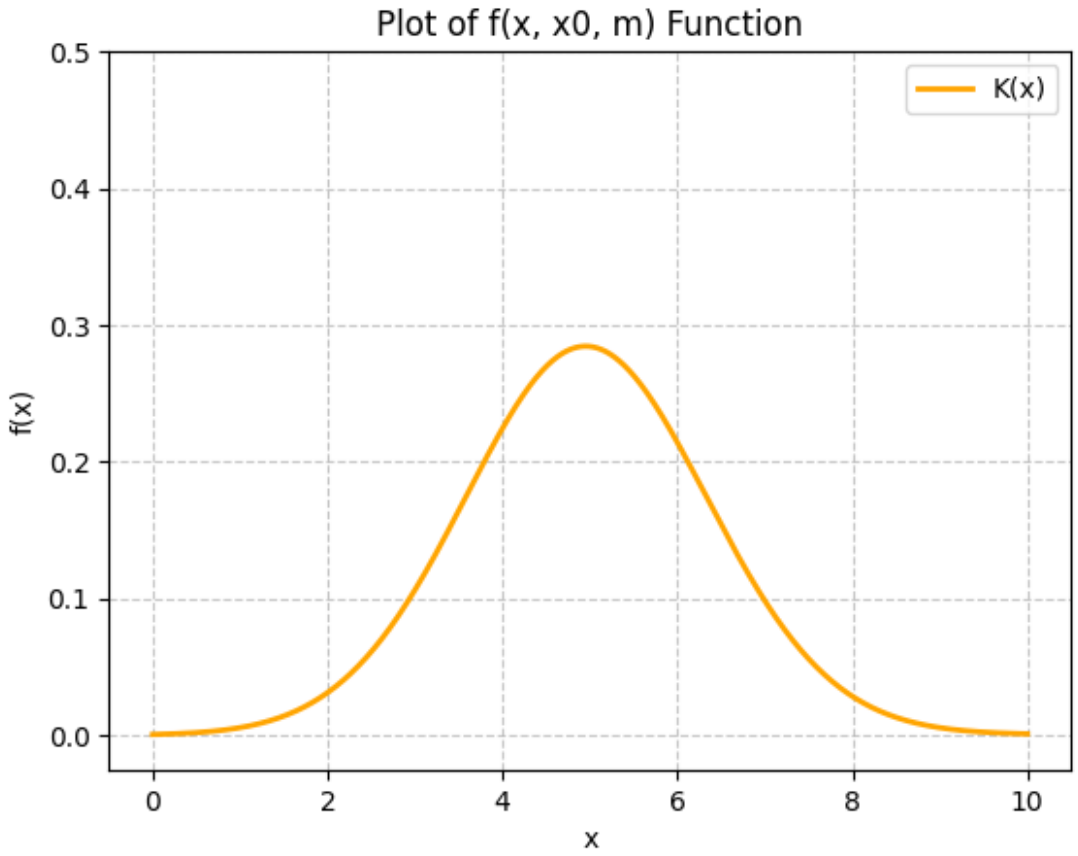

```
def K2(x, x0):
    return 1. / math.sqrt(2 * math.pi) * math.exp(-(x - x0)** 2 / 2)

x_values = np.linspace(0, 10, 500)
y_values = [K2(x, 4) for x in x_values]

# Plot the function
plt.plot(x_values, y_values, label='K(x)', color='orange',
linewidth=2)
plt.title('Plot of K(x, x0) Function')
plt.xlabel('x')
plt.ylabel('K(x)')
plt.grid(True, linestyle='--', alpha=0.7)
plt.xlim(- (10 * .05), 10.5)
plt.ylim(- (.5 * .05), 0.5)
```

```
plt.legend()
plt.show()
```



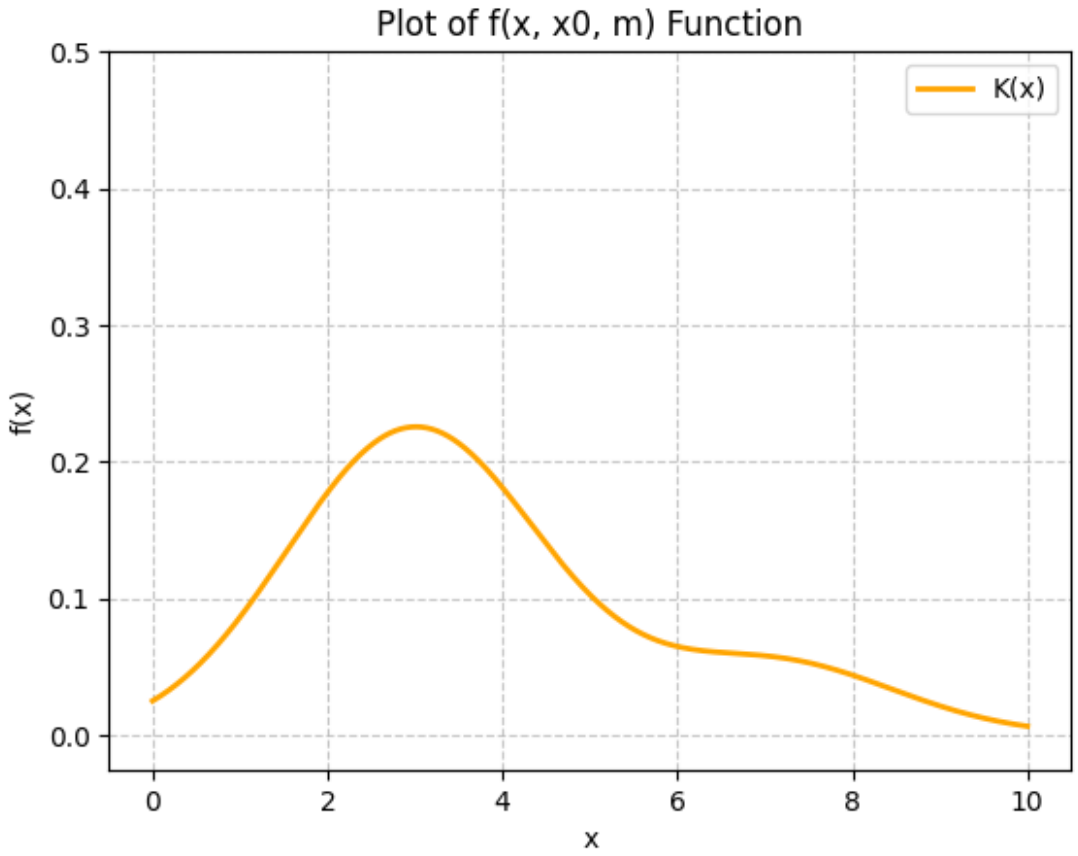

```
def f(x, x0, m=1000):
    return 1./m * 1./math.sqrt(2 * math.pi) * sum(math.exp(-(x -
element) ** 2 / 2) for element in x0)

x_values = np.linspace(0, 10, 1000)

x0 = np.random.normal(5, 1, 1000)

y_values = [f(x, x0) for x in x_values]



plt.plot(x_values, y_values, label='K(x)', color='orange',
linewidth=2)
plt.title('Plot of f(x, x0, m) Function')
plt.xlabel('x')
plt.ylabel('f(x)')
plt.grid(True, linestyle='--', alpha=0.7)
plt.xlim(- (10 * .05), 10.5)
plt.ylim(- (.5 * .05), 0.5)
```

```
plt.legend()
plt.show()
```



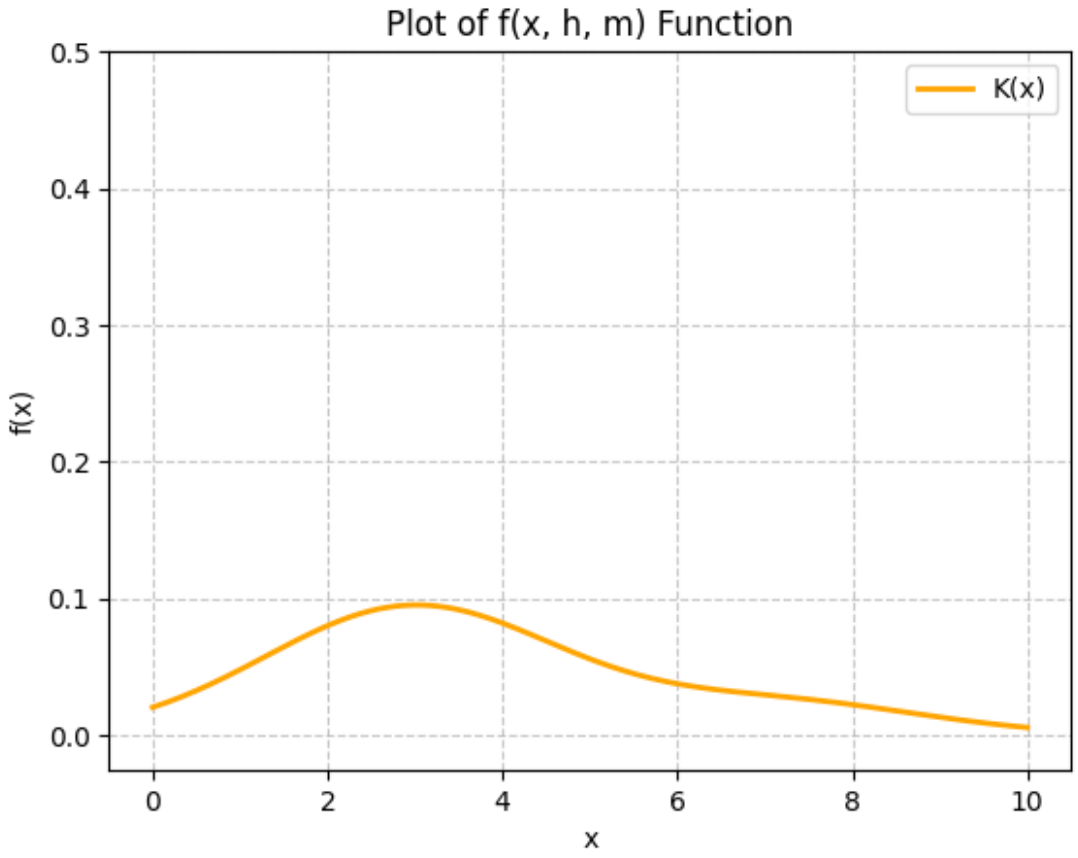

```
def fnew(x, x0, m=1000):
    return 1./m * 1./math.sqrt(2 * math.pi) * sum(math.exp(-(x -
element) ** 2 / 2) for element in x0)

sample_size = 1000
x0 = np.concatenate([np.random.normal(3, 1, int(0.8 * sample_size)),
np.random.normal(7, 1, int(0.2 * sample_size))])

x_values = np.linspace(0, 10, sample_size)
y_values = [fnew(x, x0) for x in x_values]

# Plot the function
plt.plot(x_values, y_values, label='K(x)', color='orange',
linewidth=2)
plt.title('Plot of f(x, x0, m) Function')
plt.xlabel('x')
plt.ylabel('f(x)')
plt.grid(True, linestyle='--', alpha=0.7)
plt.xlim(- (10 * .05), 10.5)
plt.ylim(- (.5 * .05), 0.5)
```

```
plt.legend()
plt.show()
```




```
def fh(x, x0, h, m=1000):
    return 1./ (m * h) * 1./math.sqrt(2 * math.pi) * sum(math.exp(-((x
- element) / h) ** 2 / 2) for element in x0)

sample_size = 500
x0 = np.concatenate([np.random.normal(3, 1, int(0.8 * sample_size)),
np.random.normal(7, 1, int(0.2 * sample_size))])

x_values = np.linspace(0, 10, sample_size)
y_values = [fh(x, x0, 1.337) for x in x_values]

# Plot the function
plt.plot(x_values, y_values, label='K(x)', color='orange',
linewidth=2)
plt.title('Plot of f(x, h, m) Function')
plt.xlabel('x')
plt.ylabel('f(x)')
plt.grid(True, linestyle='--', alpha=0.7)
plt.xlim(- (10 * .05), 10.5)
plt.ylim(- (.5 * .05), 0.5)
```

```
plt.legend()
plt.show()
```




```
jak obliczyc h

jest na mailu w ksiazce i rownania - sigma
```

```
  Cell In[44], line 1
    jak obliczyc h
        ^
SyntaxError: invalid syntax
```