```
In [ ]:  import os

         import numpy as np
         import random as rnd
         import matplotlib.pyplot as plt

         %matplotlib inline
```
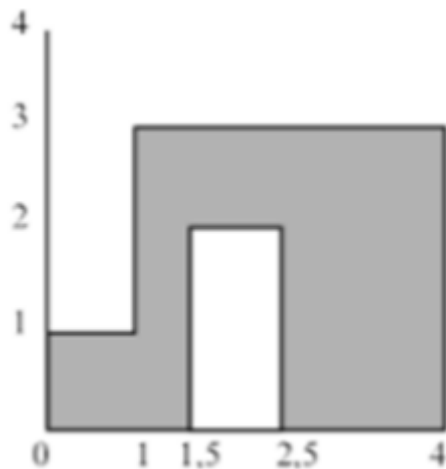
Lab 3: Monte Carlo Method

Bondar Petro (Variant 2)

Function:

$$\begin{cases} 0 \leq y \leq 1, & \text{if} \quad 0 \leq x < 1 \\ 2 \leq y \leq 3, & \text{if} \quad 1.5 < x < 2.5 \\ 0 \leq y \leq 3, & \text{if} \quad 1 \leq x \leq 1.5 \text{ or } 2.5 \leq x \leq 4 \end{cases}$$

Exact area value: 8 (= 12 - 2 - 2)

Generating random points

```
In [ ]:  def generate_points(x_low, x_high, y_low, y_high, amount):
```

```
    return [(rnd.uniform(x_low, x_high), rnd.uniform(y_low, y_high)) for i in range(0, amount)]
```

Count number of points inside the figure and add them to list

In [ ]:
```
# Function to decide whether point inside or outside figure (Variant 2)
def in_figure(point):
    x, y = point
    return not ((x < 1 and y > 1) or (x > 1.5 and x < 2.5 and y < 2))
```

In [ ]:
```
# Fuction that returns count of points in figure and list of this points
def calculate_inside(set_of_points):
    counter = 0
    inside = []
    outside = []

    for point in set_of_points:
        if in_figure(point):
            counter = counter + 1
            inside.append(point)
        else:
            outside.append(point)

    return counter, inside, outside
```

Functions to calculate area and print approximation

In [ ]:
```
def calculate_area(x_low, x_high, y_low, y_high, inside, sample_size):
    return (inside / sample_size) * (x_high - x_low) * (y_high - y_low)
```

In [ ]:
```
def print_scatter_plot(inside, outside):
    point_size = 5
    x, y = zip(*inside)
    plt.scatter(x, y, c = 'red', s = point_size)

    x, y = zip(*outside)
    plt.scatter(x, y, c = 'black', s = point_size)

    plt.show()
```

Calculate area of figure

```python
sample_size = 10000
low_x, high_x = 0, 4
low_y, high_y = 0, 3

sample = generate_points(low_x, high_x, low_y, high_y, sample_size)
count, inside, outside = calculate_inside(sample)

print('Approximate area of figure is', calculate_area(low_x, high_x, low_y, high_y, count, sample_size))
print_scatter_plot(inside, outside)
```

Approximate area of figure is 8.0088