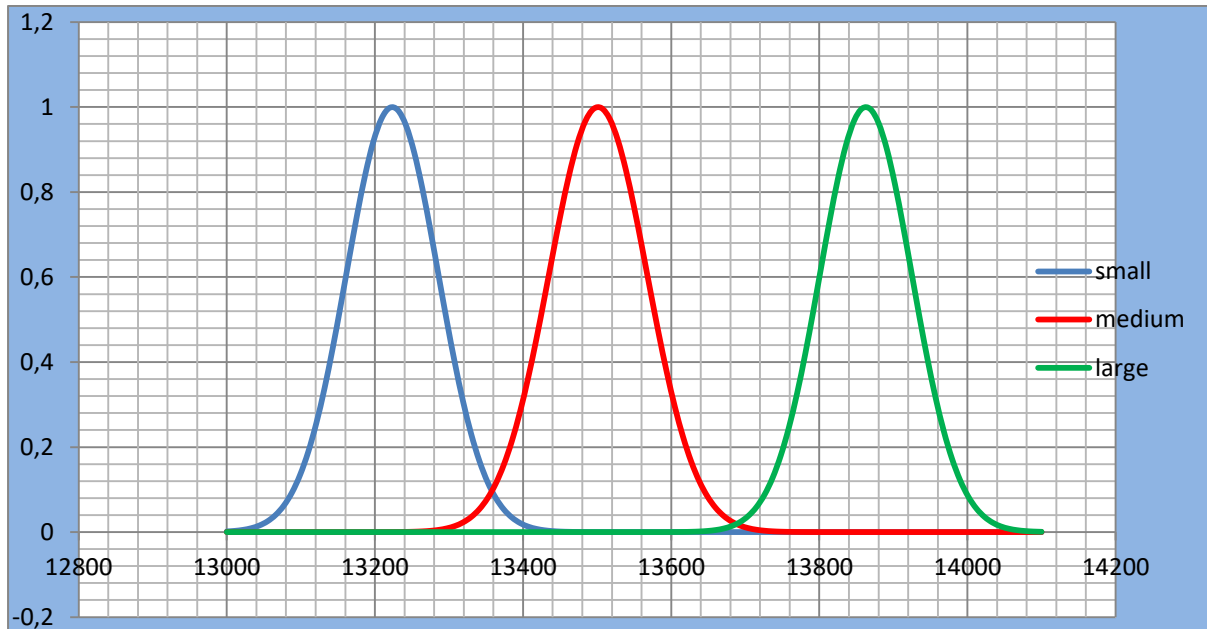


**Task №11.**

Membership function:



small:

avg:13223,486

std:7730,824

medium:

avg:13501,289

std:8795,126

large:

avg:13862,816

std:7699,625

Rules:

if  $x(t-1) = \text{small}$  and  $x(t) = \text{small}$  then  $y = 1$

if  $x(t-1) = \text{small}$  and  $x(t) = \text{medium}$  then  $y = 2$

if  $x(t-1) = \text{small}$  and  $x(t) = \text{large}$  then  $y = 3$

if  $x(t-1) = \text{medium}$  and  $x(t) = \text{small}$  then  $y = 4$

if  $x(t-1) = \text{medium}$  and  $x(t) = \text{medium}$  then  $y = 5$

if  $x(t-1) = \text{medium}$  and  $x(t) = \text{large}$  then  $y = 6$

if  $x(t-1) = \text{large}$  and  $x(t) = \text{small}$  then  $y = 7$

if  $x(t-1) = \text{large}$  and  $x(t) = \text{medium}$  then  $y = 8$

if  $x(t-1) = \text{large}$  and  $x(t) = \text{large}$  then  $y = 9$

Create table, fill column y and prediction:

| t  | x(t)     | x(t-1)   | how-big | x(t-2)   | how-big | y   | prediction x(t) |
|----|----------|----------|---------|----------|---------|-----|-----------------|
| 63 | ---      | 13211.99 | small   | 13577.87 | medium  | 2   | 13223.4861      |
| 62 | 13211.99 | 13577.87 | medium  | 13861.75 | large   | 6   | 13223.4861      |
| 61 | 13577.87 | 13861.75 | large   | 13907.25 | large   | 9   | 13862.816       |
| 60 | 13861.75 | 13907.25 | large   | 13950.98 | large   | 9   | 13862.816       |
| 59 | 13907.25 | 13950.98 | large   | 13463.33 | medium  | 8   | 13862.816       |
| 58 | 13950.98 | 13463.33 | medium  | 13181.91 | small   | 4   | 13501.2895      |
| 57 | 13463.33 | 13181.91 | small   | 13468.78 | medium  | 2   | 13223.4861      |
| 56 | 13181.91 | 13468.78 | medium  | 13971.55 | large   | 6   | 13223.4861      |
| 55 | 13468.78 | 13971.55 | large   | 13918.22 | large   | 9   | 13862.816       |
| 54 | 13971.55 | 13918.22 | large   | 13226.53 | small   | 7   | 13501.2895      |
| 53 | 13918.22 | 13226.53 | small   | 13235.88 | small   | 1   | 13223.4861      |
| 52 | 13226.53 | 13235.88 | small   | 13378.87 | medium  | 2   | 13223.4861      |
| 51 | 13235.88 | 13378.87 | medium  | 13322.13 | small   | 3   | 13501.2895      |
| 50 | 13378.87 | 13322.13 | small   | 13041.85 | small   | 1   | 13223.4861      |
| 49 | 13322.13 | 13041.85 | small   | 13289.29 | small   | 1   | 13223.4861      |
| 48 | 13041.85 | 13289.29 | small   | 13577.3  | medium  | 2   | 13223.4861      |
| 47 | 13289.29 | 13577.3  | medium  | 13565.84 | medium  | 5   | 13501.2895      |
| 46 | 13577.3  | 13565.84 | medium  | 13611.68 | medium  | 5   | 13501.2895      |
| 45 | 13565.84 | 13611.68 | medium  | 13649.97 | medium  | 5   | 13501.2895      |
| 44 | 13611.68 | 13649.97 | medium  | 13649.97 | medium  | 5   | 13501.2895      |
| 43 | 13649.97 | 13649.97 | medium  | 13501.7  | medium  | 5   | 13501.2895      |
| 42 | 13649.97 | 13501.7  | medium  | 13577.87 | medium  | 5   | 13501.2895      |
| 41 | 13501.7  | 13577.87 | medium  | 13861.75 | large   | 6   | 13223.4861      |
| 40 | 13577.87 | 13861.75 | large   | 13907.25 | large   | 9   | 13862.816       |
| 39 | 13861.75 | 13907.25 | large   | 13950.98 | large   | 9   | 13862.816       |
| 38 | 13907.25 | 13950.98 | large   | 13971.55 | large   | 9   | 13862.816       |
| 37 | 13950.98 | 13971.55 | large   | 13918.22 | large   | 9   | 13862.816       |
| 36 | 13971.55 | 13918.22 | large   | 13226.53 | small   | 7   | 13501.2895      |
| 35 | 13918.22 | 13226.53 | small   | 13028.92 | small   | 1   | 13223.4861      |
| 34 | 13226.53 | 13028.92 | small   | 13351.74 | small   | 1   | 13223.4861      |
| 33 | 13028.92 | 13351.74 | small   | 13448.86 | medium  | 3   | 13501.2895      |
| 32 | 13351.74 | 13448.86 | medium  | 14000.41 | large   | 6   | 13223.4861      |
| 31 | 13448.86 | 14000.41 | large   | 13851.08 | large   | 9   | 13862.816       |
| 30 | 14000.41 | 13851.08 | large   | 13943.42 | large   | 9   | 13862.816       |
| 29 | 13851.08 | 13943.42 | large   | 13716.95 | large   | 9   | 13862.816       |
| 28 | 13943.42 | 13716.95 | large   | 13785.79 | large   | 9   | 13862.816       |
| 27 | 13716.95 | 13785.79 | large   | 13473.57 | medium  | 8   | 13862.816       |
| 26 | 13785.79 | 13473.57 | medium  | 13265.47 | small   | 4   | 13501.2895      |
| 25 | 13473.57 | 13265.47 | small   | 13358.31 | medium  | 2   | 13223.4861      |
| 24 | 13265.47 | 13358.31 | medium  | 13211.99 | small   | 3   | 13501.2895      |
| 23 | 13358.31 | 13211.99 | small   | 13362.37 | medium  | 2   | 13223.4861      |
| 22 | 13211.99 | 13362.37 | medium  | 13851.08 | large   | 5   | 13501.2895      |
| 21 | 13362.37 | 13851.08 | large   | 13943.42 | large   | 9   | 13862.816       |
| 20 | 13851.08 | 13943.42 | large   | 13716.95 | large   | 9   | 13862.816       |
| 19 | 13943.42 | 13716.95 | large   | 13785.79 | large   | 9   | 13862.816       |
| 18 | 13716.95 | 13785.79 | large   | 13851.08 | large   | 9   | 13862.816       |
| 17 | 13785.79 | 13851.08 | large   | 13943.42 | large   | 9   | 13862.816       |
| 16 | 13851.08 | 13943.42 | large   | 13716.95 | large   | 9   | 13862.816       |
| 15 | 13943.42 | 13716.95 | large   | 13785.79 | large   | 9   | 13862.816       |
| 14 | 13716.95 | 13785.79 | large   | 13463.33 | medium  | 8   | 13862.816       |
| 13 | 13785.79 | 13463.33 | medium  | 13181.91 | small   | 4   | 13501.2895      |
| 12 | 13463.33 | 13181.91 | small   | 13468.78 | medium  | 2   | 13223.4861      |
| 11 | 13181.91 | 13468.78 | medium  | 13904.3  | large   | 6   | 13223.4861      |
| 10 | 13468.78 | 13904.3  | large   | 13657.86 | medium  | 8   | 13862.816       |
| 9  | 13904.3  | 13657.86 | medium  | 13270.68 | small   | 4   | 13501.2895      |
| 8  | 13657.86 | 13270.68 | small   | 13305.47 | small   | 1   | 13223.4861      |
| 7  | 13270.68 | 13305.47 | small   | 13424.88 | medium  | 2   | 13223.4861      |
| 6  | 13305.47 | 13424.88 | medium  | 13442.52 | medium  | 5   | 13501.2895      |
| 5  | 13424.88 | 13442.52 | medium  | 13403.42 | medium  | 5   | 13501.2895      |
| 4  | 13442.52 | 13403.42 | medium  | 13739.39 | large   | 6   | 13223.4861      |
| 3  | 13403.42 | 13739.39 | large   | 13815.6  | large   | 9   | 13862.816       |
| 2  | 13739.39 | 13815.6  | large   | 13725.13 | large   | 9   | 13862.816       |
| 1  | 13815.6  | 13725.13 | large   | ---      | ---     | --- | ---             |
| 0  | 13725.13 | ---      | ---     | ---      | ---     | --- | ---             |

Rules of prediction:

if  $y=1$  or  $y=2$  or  $y=6$  that  $x(t)=$  small;

if  $y=7$  or  $y=4$  or  $y=5$  or  $y=3$  that  $x(t)=$  medium;

if  $y=8$  or  $y=9$  that  $x(t)=$  large;

Graphs:

