**Задача №5 Проверка гипотез о параметрах нормального распределения**

**Задание**.

По данной выборке из нормально распределенной генеральной совокупности:

1) постройте критерий уровня и проверьте гипотезу против односторонней альтернативы , если неизвестно;

2) постройте критерий уровня и проверьте гипотезу против альтернативы , если неизвестно;

3) постройте оптимальный критерий уровня и проверьте против простой альтернативы , если известно;

4) найдите ошибку второго рода критерия ;

5) найдите такие значения для которых ошибка второго рода критерия не превосходит ;

6) постройте совмещенные графики гистограммы относительных частот данной выборки и плотностей нормального распределения с параметрами и

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Вар |  |  |  |  |  |  |  |  |  |
| дем | 0.05 |  |  | 2 |  |  | 2 | 0.1 | 100 |
| 1 | 0,1 |  |  | 3 |  |  | 3 | 0.15 | 100 |
| 2 | 0.05 |  |  | 3.3 |  |  | 3 | 0.05 | 80 |
| 3 | 0.05 |  |  | 3.8 |  |  | 4 | 0.05 | 90 |
| 4 | 0.05 |  |  | 3.5 |  |  | 3.8 | 0.1 | 120 |
| 5 | 0.1 |  |  | 4 |  |  | 3,7 | 0.05 | 120 |
| 6 | 0.1 |  |  | 2.4 |  |  | 2.5 | 0.1 | 100 |
| 7 | 0.05 |  |  | 1.4 |  |  | 1.5 | 0.05 | 90 |
| 8 | 0.05 |  |  | 1.7 |  |  | 1.75 | 0.1 | 80 |
| 9 | 0.1 |  |  | 2.1 |  |  | 2.2 | 0.1 | 100 |
| 10 | 0.1 |  |  | 3.2 |  |  | 3.4 | 0.15 | 120 |
| 11 | 0.1 |  |  | 2.4 |  |  | 2.5 | 0.2 | 90 |
| 12 | 0.05 |  |  | 2.4 |  |  | 2 | 0.1 | 80 |
| 13 | 0.05 |  |  | 1.8 |  |  | 1.6 | 0.05 | 100 |
| 14 | 0.05 |  |  | 1.9 |  |  | 2 | 0.1 | 90 |
| 15 | 0.05 |  |  | 2.5 |  |  | 2.7 | 0.15 | 80 |
| 16 | 0.1 |  |  | 1.3 |  |  | 1.3 | 0.1 | 120 |
| 17 | 0.1 |  |  | 2.3 |  |  | 2.4 | 0.1 | 100 |
| 18 | 0.04 | 2 |  | 1.2 |  |  | 1 | 0.05 | 150 |
| 19 | 0.08 | 3 |  | 1.1 |  |  | 1.2 | 0.05 | 180 |
| 20 | 0.1 | 3.5 |  | 2 |  |  | 2 | 0.1 | 120 |
| 21 | 0.04 | 4 |  | 1.3 |  |  | 1.5 | 0.1 | 100 |
| 22 | 0.05 | -1.0 |  | 1.1 |  |  | 1.2 | 0.1 | 120 |
| 23 | 0.08 | -2 |  | 2.4 |  |  | 2.2 | 0.1 | 150 |
| 24 | 0.1 | -5.5 |  | 2.5 |  |  | 2.3 | 0.05 | 180 |
| 25 | 0.05 | -6 |  | 3 |  |  | 3 | 0.05 | 100 |

Вариант 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -7.057 | -0.597 | 2.644 | 0.847 | 4.779 | -0.814 | 3.664 | 0.461 | -1.996 | -1.144 |
| 8.821 | -1.539 | -5.106 | 2.238 | 2.774 | -0.907 | 1.629 | -2.74 | 4.35 | 2.15 |
| 5.465 | 7.115 | 2.296 | 1.714 | 5.271 | 4.313 | 10.178 | 2.85 | 0.127 | 4.985 |
| 1.051 | 3.38 | -5.12 | 0.215 | 2.667 | 4.954 | 1.887 | 3.965 | 1.683 | 3.971 |
| 2.753 | 3.884 | 2.547 | -1.089 | 1.434 | 2.129 | 4.038 | -0.874 | 1.939 | 3.571 |
| -1.141 | -1.219 | 3.512 | 1.444 | 7.499 | -1.068 | 4.765 | -0.619 | 4.714 | -1.039 |
| 3.857 | 0.248 | 3.422 | 3.766 | -1.48 | 4.918 | 2.128 | 1.442 | 6.915 | 2.374 |
| 1.787 | 5.07 | 1.669 | 8.357 | 3.922 | -0.568 | 4.976 | 2.007 | -3.757 | 2.549 |
| 2.236 | 5.021 | 3.218 | 5.01 | -1.68 | 0.547 | 0.305 | -1.237 | 4.918 | 2.762 |
| 2.14e-3 | -6.832 | 4.592 | -0.413 | 2.401 | -1.62 | 4.044 | 2.327 | 1.522 | 3.541 |

Вариант 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -21.057 | -14.597 | -11.356 | -13.153 | -9.221 | -14.814 | -10.336 | -13.539 | -15.996 | -15.144 |
| -5.179 | -15.539 | -19.106 | -11.762 | -11.226 | -14.907 | -12.371 | -16.74 | -9.65 | -11.85 |
| -8.535 | -6.885 | -11.704 | -12.286 | -8.729 | -9.687 | -3.822 | -11.15 | -13.873 | -9.015 |
| -12.949 | -10.62 | -19.12 | -13.785 | -11.333 | -9.046 | -12.113 | -10.035 | -12.317 | -10.029 |
| -11.247 | -10.116 | -11.453 | -15.089 | -12.566 | -11.871 | -9.962 | -14.874 | -12.061 | -10.429 |
| -15.141 | -15.219 | -10.488 | -12.556 | -6.501 | -15.068 | -9.235 | -14.619 | -9.286 | -15.039 |
| -10.143 | -13.752 | -10.578 | -10.234 | -15.48 | -9.082 | -11.872 | -12.558 | -7.085 | -11.626 |
| -12.213 | -8.93 | -12.331 | -5.643 | -10.078 | -14.568 | -9.024 | -11.993 | -17.757 | -11.451 |

Вариант 3

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -22.076 | -13.463 | -9.141 | -11.538 | -6.295 | -13.752 | -7.781 | -12.052 | -15.328 | -14.192 |
| -0.905 | -14.718 | -19.475 | -9.682 | -8.968 | -13.876 | -10.495 | -16.32 | -6.866 | -9.801 |
| -5.38 | -3.18 | -9.605 | -10.381 | -5.639 | -6.916 | 0.904 | -8.867 | -12.497 | -6.02 |
| -11.266 | -8.161 | -19.493 | -12.38 | -9.111 | -6.061 | -10.151 | -7.38 | -10.422 | -7.372 |
| -8.997 | -7.488 | -9.27 | -14.119 | -10.755 | -9.828 | -7.283 | -13.833 | -10.081 | -7.905 |
| -14.189 | -14.293 | -7.984 | -10.741 | -2.668 | -14.09 | -6.313 | -13.492 | -6.381 | -14.051 |
| -7.524 | -12.336 | -8.104 | -7.646 | -14.64 | -6.109 | -9.829 | -10.744 | -3.446 | -9.502 |
| -10.284 | -5.906 | -10.441 | -1.524 | -7.437 | -13.424 | -6.032 | -9.991 | -17.676 | -9.268 |
| -9.686 | -5.972 | -8.376 | -5.987 | -14.907 | -11.937 | -12.259 | -14.316 | -6.11 | -8.984 |

Вариант 4

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -24.076 | -15.463 | -11.141 | -13.538 | -8.295 | -15.752 | -9.781 | -14.052 | -17.328 | -16.192 |
| -2.905 | -16.718 | -21.475 | -11.682 | -10.968 | -15.876 | -12.495 | -18.32 | -8.866 | -11.801 |
| -7.38 | -5.18 | -11.605 | -12.381 | -7.639 | -8.916 | -1.096 | -10.867 | -14.497 | -8.02 |
| -13.266 | -10.161 | -21.493 | -14.38 | -11.111 | -8.061 | -12.151 | -9.38 | -12.422 | -9.372 |
| -10.997 | -9.488 | -11.27 | -16.119 | -12.755 | -11.828 | -9.283 | -15.833 | -12.081 | -9.905 |
| -16.189 | -16.293 | -9.984 | -12.741 | -4.668 | -16.09 | -8.313 | -15.492 | -8.381 | -16.051 |
| -9.524 | -14.336 | -10.104 | -9.646 | -16.64 | -8.109 | -11.829 | -12.744 | -5.446 | -11.502 |
| -12.284 | -7.906 | -12.441 | -3.524 | -9.437 | -15.424 | -8.032 | -11.991 | -19.676 | -11.268 |
| -11.686 | -7.972 | -10.376 | -7.987 | -16.907 | -13.937 | -14.259 | -16.316 | -8.11 | -10.984 |
| -14.664 | -23.777 | -8.544 | -15.218 | -11.465 | -16.827 | -9.274 | -11.564 | -12.637 | -9.946 |
| -12.638 | -11.214 | -10.687 | -11.958 | -9.951 | -15.512 | -15.686 | -12.427 | -17.183 | -17.256 |
| -6.052 | -6.995 | -14.991 | -12.903 | -10.693 | -12.486 | -11.009 | -7.771 | -10.728 | -11.338 |

Вариант 5

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -7.37 | 0.597 | 4.594 | 2.377 | 7.227 | 0.329 | 5.853 | 1.902 | -1.129 | -0.078 |
| 12.213 | -0.565 | -4.965 | 4.094 | 4.754 | 0.214 | 3.342 | -2.046 | 6.699 | 3.984 |
| 8.074 | 10.108 | 4.165 | 3.448 | 7.834 | 6.653 | 13.887 | 4.848 | 1.49 | 7.481 |
| 2.629 | 5.501 | -4.981 | 1.598 | 4.622 | 7.443 | 3.66 | 6.223 | 3.41 | 6.231 |
| 4.728 | 6.124 | 4.475 | -0.01 | 3.102 | 3.959 | 6.314 | 0.255 | 3.725 | 5.738 |
| -0.074 | -0.171 | 5.665 | 3.115 | 10.582 | 0.016 | 7.211 | 0.57 | 7.147 | 0.052 |
| 6.09 | 1.639 | 5.554 | 5.978 | -0.492 | 7.399 | 3.958 | 3.112 | 9.862 | 4.261 |
| 3.538 | 7.587 | 3.392 | 11.64 | 6.171 | 0.633 | 7.471 | 3.808 | -3.3 | 4.477 |
| 4.091 | 7.526 | 5.302 | 7.512 | -0.739 | 2.008 | 1.71 | -0.193 | 7.399 | 4.74 |
| 1.336 | -7.093 | 6.997 | 0.824 | 4.295 | -0.665 | 6.322 | 4.204 | 3.211 | 5.7 |
| 3.21 | 4.527 | 5.015 | 3.838 | 5.695 | 0.551 | 0.39 | 3.405 | -0.994 | -1.062 |
| 9.302 | 8.43 | 1.033 | 2.965 | 5.009 | 3.35 | 4.717 | 7.712 | 4.977 | 4.413 |

Вариант 6

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0.653 | 6.036 | 8.737 | 7.239 | 10.516 | 5.855 | 9.587 | 6.918 | 4.87 | 5.58 |
| 13.884 | 5.251 | 2.278 | 8.399 | 8.845 | 5.777 | 7.891 | 4.25 | 10.159 | 8.325 |
| 11.088 | 12.462 | 8.447 | 7.962 | 10.926 | 10.128 | 15.015 | 8.908 | 6.639 | 10.687 |
| 7.409 | 9.35 | 2.267 | 6.712 | 8.755 | 10.662 | 8.106 | 9.837 | 7.936 | 9.843 |
| 8.827 | 9.77 | 8.656 | 5.626 | 7.728 | 8.307 | 9.898 | 5.805 | 8.149 | 9.509 |
| 5.582 | 5.517 | 9.46 | 7.737 | 12.783 | 5.644 | 10.504 | 6.018 | 10.462 | 5.668 |
| 9.747 | 6.74 | 9.385 | 9.671 | 5.3 | 10.632 | 8.307 | 7.735 | 12.296 | 8.511 |
| 8.023 | 10.759 | 7.924 | 13.497 | 9.802 | 6.06 | 10.68 | 8.206 | 3.403 | 8.657 |
| 8.396 | 10.718 | 9.215 | 10.708 | 5.133 | 6.989 | 6.788 | 5.502 | 10.631 | 8.835 |
| 6.535 | 0.84 | 10.36 | 6.189 | 8.534 | 5.183 | 9.904 | 8.473 | 7.802 | 9.484 |

Вариант 7

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -5.349 | -3.792 | -5.046 | -3.602 | -3.679 | -4.021 | -3.032 | -3.54 | -2.713 | -3.712 |
| -1.974 | -3.091 | -3.349 | -4.723 | -4.762 | -5.851 | -2.437 | -5.524 | -6.114 | -3.458 |
| -3.83 | -4.345 | -4.13 | -5.538 | -3.044 | -2.588 | -2.286 | -4.786 | -5.709 | -2.816 |
| -3.582 | -6.188 | -3.406 | -5.882 | -5.123 | -1.893 | -3.37 | -4.028 | -4.012 | -3.965 |
| -3.264 | -3.596 | -7.776 | -5.917 | -2.358 | -3.001 | -4.458 | -3.801 | -1.446 | -5.393 |
| -5.678 | -1.508 | -6.87 | -6.385 | -5.678 | -2.35 | -3.118 | -7.268 | -3.179 | -5.171 |
| -5.438 | -4.615 | -4.507 | -2.725 | -3.9 | -2.747 | -5.588 | -4.371 | -5.644 | -6.257 |
| -3.723 | -3.819 | -4.738 | -2.694 | -4.855 | -2.118 | -3.017 | -4.533 | -5.116 | -5.111 |
| -3.84 | -6.414 | -3.907 | -5.969 | -2.148 | -5.577 | -1.768 | -6.511 | -4.633 | -4.385 |

Вариант 8

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -7.934 | -4.058 | -2.114 | -3.192 | -0.833 | -4.188 | -1.501 | -3.423 | -4.898 | -4.386 |
| 1.593 | -4.623 | -6.764 | -2.357 | -2.036 | -4.244 | -2.723 | -5.344 | -1.09 | -2.41 |
| -0.421 | 0.569 | -2.322 | -2.671 | -0.537 | -1.112 | 2.407 | -1.99 | -3.624 | -0.709 |
| -3.069 | -1.672 | -6.772 | -3.571 | -2.1 | -0.728 | -2.568 | -1.321 | -2.69 | -1.317 |
| -2.048 | -1.37 | -2.172 | -4.354 | -2.84 | -2.423 | -1.277 | -4.225 | -2.537 | -1.557 |
| -4.385 | -4.432 | -1.593 | -2.833 | 0.8 | -4.341 | -0.841 | -4.071 | -0.872 | -4.323 |
| -1.386 | -3.551 | -1.647 | -1.441 | -4.588 | -0.749 | -2.423 | -2.835 | 0.449 | -2.276 |
| -2.628 | -0.658 | -2.699 | 1.314 | -1.347 | -4.041 | -0.714 | -2.496 | -5.954 | -2.171 |

Вариант 9

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -3.442 | 1.295 | 3.672 | 2.354 | 5.238 | 1.136 | 4.421 | 2.071 | 0.269 | 0.894 |
| 8.202 | 0.605 | -2.011 | 3.375 | 3.767 | 1.068 | 2.928 | -0.276 | 4.924 | 3.31 |
| 5.741 | 6.951 | 3.417 | 2.991 | 5.599 | 4.896 | 9.197 | 3.823 | 1.827 | 5.389 |
| 2.504 | 4.212 | -2.021 | 1.891 | 3.689 | 5.366 | 3.117 | 4.641 | 2.968 | 4.645 |
| 3.752 | 4.582 | 3.601 | 0.934 | 2.785 | 3.294 | 4.695 | 1.092 | 3.155 | 4.352 |
| 0.896 | 0.839 | 4.309 | 2.793 | 7.233 | 0.95 | 5.228 | 1.28 | 5.19 | 0.972 |
| 4.562 | 1.915 | 4.243 | 4.495 | 0.648 | 5.34 | 3.294 | 2.791 | 6.805 | 3.474 |
| 3.044 | 5.452 | 2.957 | 7.862 | 4.61 | 1.317 | 5.383 | 3.205 | -1.022 | 3.602 |
| 3.373 | 5.415 | 4.093 | 5.407 | 0.501 | 2.135 | 1.957 | 0.826 | 5.34 | 3.759 |
| 1.735 | -3.277 | 5.101 | 1.43 | 3.494 | 0.545 | 4.699 | 3.44 | 2.85 | 4.33 |

Вариант 10

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -17.566 | -10.03 | -6.248 | -8.346 | -3.758 | -10.283 | -5.058 | -8.795 | -11.662 | -10.668 |
| 0.958 | -11.129 | -15.291 | -6.722 | -6.097 | -10.392 | -7.433 | -12.53 | -4.258 | -6.826 |
| -2.957 | -1.033 | -6.654 | -7.333 | -3.184 | -4.301 | 2.541 | -6.009 | -9.185 | -3.518 |
| -8.107 | -5.391 | -15.306 | -9.083 | -6.222 | -3.554 | -7.132 | -4.708 | -7.369 | -4.7 |
| -6.122 | -4.802 | -6.361 | -10.604 | -7.66 | -6.85 | -4.622 | -10.353 | -7.071 | -5.167 |
| -10.665 | -10.756 | -5.236 | -7.648 | -0.584 | -10.579 | -3.774 | -10.055 | -3.834 | -10.545 |
| -4.834 | -9.044 | -5.341 | -4.94 | -11.06 | -3.595 | -6.851 | -7.651 | -1.265 | -6.564 |
| -7.248 | -3.418 | -7.386 | 0.416 | -4.757 | -9.996 | -3.528 | -6.992 | -13.716 | -6.36 |
| -6.725 | -3.475 | -5.579 | -3.489 | -11.294 | -8.695 | -8.977 | -10.777 | -3.596 | -6.111 |
| -9.331 | -17.304 | -3.976 | -9.815 | -6.532 | -11.223 | -4.615 | -6.618 | -7.558 | -5.203 |
| -7.558 | -6.312 | -5.851 | -6.964 | -5.207 | -10.073 | -10.226 | -7.374 | -11.535 | -11.599 |
| -1.796 | -2.62 | -9.617 | -7.79 | -5.856 | -7.426 | -6.133 | -3.3 | -5.887 | -6.421 |

Вариант 11

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -2.247 | 3.136 | 5.837 | 4.339 | 7.616 | 2.955 | 6.687 | 4.018 | 1.97 | 2.68 |
| 10.984 | 2.351 | -0.622 | 5.499 | 5.945 | 2.877 | 4.991 | 1.35 | 7.259 | 5.425 |
| 8.188 | 9.562 | 5.547 | 5.062 | 8.026 | 7.228 | 12.115 | 6.008 | 3.739 | 7.787 |
| 4.509 | 6.45 | -0.633 | 3.812 | 5.855 | 7.762 | 5.206 | 6.937 | 5.036 | 6.943 |
| 5.927 | 6.87 | 5.756 | 2.726 | 4.828 | 5.407 | 6.998 | 2.905 | 5.249 | 6.609 |
| 2.682 | 2.617 | 6.56 | 4.837 | 9.883 | 2.744 | 7.604 | 3.118 | 7.562 | 2.768 |
| 6.847 | 3.84 | 6.485 | 6.771 | 2.4 | 7.732 | 5.407 | 4.835 | 9.396 | 5.611 |
| 5.123 | 7.859 | 5.024 | 10.597 | 6.902 | 3.16 | 7.78 | 5.306 | 0.503 | 5.757 |
| 5.496 | 7.818 | 6.315 | 7.808 | 2.233 | 4.089 | 3.888 | 2.602 | 7.731 | 5.935 |

Вариант 12

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -24.842 | -20.105 | -17.728 | -19.046 | -16.162 | -20.264 | -16.979 | -19.329 | -21.131 | -20.506 |
| -13.198 | -20.795 | -23.411 | -18.025 | -17.633 | -20.332 | -18.472 | -21.676 | -16.476 | -18.09 |
| -15.659 | -14.449 | -17.983 | -18.409 | -15.801 | -16.504 | -12.203 | -17.577 | -19.573 | -16.011 |
| -18.896 | -17.188 | -23.421 | -19.509 | -17.711 | -16.034 | -18.283 | -16.759 | -18.432 | -16.755 |
| -17.648 | -16.818 | -17.799 | -20.466 | -18.615 | -18.106 | -16.705 | -20.308 | -18.245 | -17.048 |
| -20.504 | -20.561 | -17.091 | -18.607 | -14.167 | -20.45 | -16.172 | -20.12 | -16.21 | -20.428 |
| -16.838 | -19.485 | -17.157 | -16.905 | -20.752 | -16.06 | -18.106 | -18.609 | -14.595 | -17.926 |
| -18.356 | -15.948 | -18.443 | -13.538 | -16.79 | -20.083 | -16.017 | -18.195 | -22.422 | -17.798 |

Вариант 13

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3.151 | 4.708 | 3.454 | 4.898 | 4.821 | 4.479 | 5.468 | 4.96 | 5.787 | 4.788 |
| 6.526 | 5.409 | 5.151 | 3.777 | 3.738 | 2.649 | 6.063 | 2.976 | 2.386 | 5.042 |
| 4.67 | 4.155 | 4.37 | 2.962 | 5.456 | 5.912 | 6.214 | 3.714 | 2.791 | 5.684 |
| 4.918 | 2.312 | 5.094 | 2.618 | 3.377 | 6.607 | 5.13 | 4.472 | 4.488 | 4.535 |
| 5.236 | 4.904 | 0.724 | 2.583 | 6.142 | 5.499 | 4.042 | 4.699 | 7.054 | 3.107 |
| 2.822 | 6.992 | 1.63 | 2.115 | 2.822 | 6.15 | 5.382 | 1.232 | 5.321 | 3.329 |
| 3.062 | 3.885 | 3.993 | 5.775 | 4.6 | 5.753 | 2.912 | 4.129 | 2.856 | 2.243 |
| 4.777 | 4.681 | 3.762 | 5.806 | 3.645 | 6.382 | 5.483 | 3.967 | 3.384 | 3.389 |
| 4.66 | 2.086 | 4.593 | 2.531 | 6.352 | 2.923 | 6.732 | 1.989 | 3.867 | 4.115 |
| 6.913 | 4.629 | 5.259 | 3.531 | 4.596 | 4.115 | 4.824 | 5.218 | 4.256 | 0.829 |

Вариант 14

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -4.538 | -0.231 | 1.929 | 0.731 | 3.352 | -0.376 | 2.61 | 0.474 | -1.164 | -0.596 |
| 6.047 | -0.859 | -3.238 | 1.659 | 2.016 | -0.438 | 1.253 | -1.66 | 3.067 | 1.6 |
| 3.81 | 4.91 | 1.698 | 1.31 | 3.681 | 3.042 | 6.952 | 2.066 | 0.251 | 3.49 |
| 0.867 | 2.42 | -3.246 | 0.31 | 1.944 | 3.469 | 1.424 | 2.81 | 1.289 | 2.814 |
| 2.002 | 2.756 | 1.865 | -0.56 | 1.123 | 1.586 | 2.859 | -0.416 | 1.459 | 2.547 |
| -0.594 | -0.646 | 2.508 | 1.13 | 5.166 | -0.545 | 3.344 | -0.246 | 3.309 | -0.526 |
| 2.738 | 0.332 | 2.448 | 2.677 | -0.82 | 3.445 | 1.585 | 1.128 | 4.777 | 1.749 |
| 1.358 | 3.547 | 1.279 | 5.738 | 2.782 | -0.212 | 3.484 | 1.505 | -2.338 | 1.866 |

Вариант 15

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -12.953 | -6.924 | -3.899 | -5.577 | -1.907 | -7.126 | -2.946 | -5.936 | -8.23 | -7.434 |
| 1.866 | -7.803 | -11.133 | -4.278 | -3.778 | -7.213 | -4.846 | -8.924 | -2.306 | -4.36 |
| -1.266 | 0.274 | -4.223 | -4.767 | -1.447 | -2.341 | 3.133 | -3.707 | -6.248 | -1.714 |
| -5.386 | -3.212 | -11.145 | -6.166 | -3.878 | -1.743 | -4.606 | -2.666 | -4.795 | -2.66 |
| -3.798 | -2.742 | -3.989 | -7.383 | -5.028 | -4.38 | -2.598 | -7.183 | -4.557 | -3.034 |
| -7.432 | -7.505 | -3.089 | -5.018 | 0.633 | -7.363 | -1.919 | -6.944 | -1.967 | -7.336 |
| -2.767 | -6.135 | -3.173 | -2.852 | -7.748 | -1.776 | -4.381 | -5.021 | 0.088 | -4.151 |
| -4.699 | -1.634 | -4.809 | 1.433 | -2.706 | -6.897 | -1.722 | -4.494 | -9.873 | -3.988 |

Вариант 16

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -7.123 | -4.539 | -3.242 | -3.961 | -2.389 | -4.626 | -2.834 | -4.116 | -5.099 | -4.758 |
| -0.772 | -4.916 | -6.343 | -3.405 | -3.191 | -4.663 | -3.648 | -5.396 | -2.56 | -3.44 |
| -2.114 | -1.454 | -3.381 | -3.614 | -2.192 | -2.575 | -0.229 | -3.16 | -4.249 | -2.306 |
| -3.88 | -2.948 | -6.348 | -4.214 | -3.233 | -2.318 | -3.545 | -2.714 | -3.627 | -2.712 |
| -3.199 | -2.746 | -3.281 | -4.736 | -3.726 | -3.448 | -2.685 | -4.65 | -3.524 | -2.872 |
| -4.757 | -4.788 | -2.895 | -3.722 | -1.3 | -4.727 | -2.394 | -4.548 | -2.414 | -4.715 |
| -2.757 | -4.201 | -2.931 | -2.794 | -4.892 | -2.333 | -3.449 | -3.723 | -1.534 | -3.351 |
| -3.585 | -2.272 | -3.632 | -0.957 | -2.731 | -4.527 | -2.309 | -3.497 | -5.803 | -3.28 |
| -3.406 | -2.292 | -3.013 | -2.296 | -4.972 | -4.081 | -4.178 | -4.795 | -2.333 | -3.195 |
| -4.299 | -7.033 | -2.463 | -4.465 | -3.34 | -4.948 | -2.682 | -3.369 | -3.691 | -2.884 |
| -3.691 | -3.264 | -3.106 | -3.488 | -2.885 | -4.554 | -4.606 | -3.628 | -5.055 | -5.077 |
| -1.716 | -1.998 | -4.397 | -3.771 | -3.108 | -3.646 | -3.203 | -2.231 | -3.118 | -3.301 |

Вариант 17

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -1.047 | 4.336 | 7.037 | 5.539 | 8.816 | 4.155 | 7.887 | 5.218 | 3.17 | 3.88 |
| 12.184 | 3.551 | 0.578 | 6.699 | 7.145 | 4.077 | 6.191 | 2.55 | 8.459 | 6.625 |
| 9.388 | 10.762 | 6.747 | 6.262 | 9.226 | 8.428 | 13.315 | 7.208 | 4.939 | 8.987 |
| 5.709 | 7.65 | 0.567 | 5.012 | 7.055 | 8.962 | 6.406 | 8.137 | 6.236 | 8.143 |
| 7.127 | 8.07 | 6.956 | 3.926 | 6.028 | 6.607 | 8.198 | 4.105 | 6.449 | 7.809 |
| 3.882 | 3.817 | 7.76 | 6.037 | 11.083 | 3.944 | 8.804 | 4.318 | 8.762 | 3.968 |
| 8.047 | 5.04 | 7.685 | 7.971 | 3.6 | 8.932 | 6.607 | 6.035 | 10.596 | 6.811 |
| 6.323 | 9.059 | 6.224 | 11.797 | 8.102 | 4.36 | 8.98 | 6.506 | 1.703 | 6.957 |
| 6.696 | 9.018 | 7.515 | 9.008 | 3.433 | 5.289 | 5.088 | 3.802 | 8.931 | 7.135 |
| 4.835 | -0.86 | 8.66 | 4.489 | 6.834 | 3.483 | 8.204 | 6.773 | 6.102 | 7.784 |

Вариант 18

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1.665 | 3.109 | 0.629 | 3.167 | 3.069 | 2.431 | -0.012 | 3.094 | 2.323 | -0.099 |
| 4.453 | 1.686 | 0.118 | 2.631 | 1.185 | 0.648 | 1.541 | 2.532 | 2.059 | 0.239 |
| 2.056 | 2.924 | 2.51 | 1.534 | 1.059 | 1.482 | 1.346 | 2.134 | 1.95 | 1.147 |
| 0.857 | 0.039 | -1.114 | 0.18 | 2.95 | 3.175 | 0.964 | 2.275 | 1.49 | 0.605 |
| 1.367 | 3.323 | 1.614 | -1.329 | 2.814 | -0.05 | 0.65 | 1.801 | 3.333 | 1.787 |
| 2.195 | 0.825 | 1.703 | 2.494 | 0.06 | 1.671 | 3.048 | 1.175 | 3.6 | 0.148 |
| 1.617 | 0.61 | 2.472 | 0.784 | 0.899 | 1.057 | 1.035 | 2.176 | 2.012 | 1.381 |
| 2.264 | 0.617 | 1.949 | 2.242 | 1.672 | 0.792 | 1.951 | 1.168 | 1.565 | 1.839 |
| 1.794 | 2.002 | 3.219 | 1.404 | 3.051 | 1.804 | 1.607 | 1.7 | 1.796 | 1.578 |
| 2.651 | 2.418 | 2.867 | 2.635 | 1.916 | 2.489 | 2.899 | 1.419 | 2.949 | 2.056 |
| -0.81 | 2.239 | 1.777 | 3.89 | 1.857 | 1.006 | 1.179 | 1.741 | 2.577 | 1.739 |
| 1.484 | 2.674 | 2.466 | 1.262 | 5.006 | 2.543 | 2.272 | 1.557 | 2.023 | 3.458 |
| 2.744 | 4.606 | 1.144 | 2.947 | 2.914 | 1.942 | 3.537 | -0.117 | 1.215 | 2.774 |
| 3.033 | 0.974 | 2.613 | 0.524 | 0.749 | 2.845 | 2.6 | 2.045 | 2.947 | 2.648 |
| 2.187 | 1.516 | 1.933 | 0.733 | 1.23 | 1.898 | 2.709 | 1.629 | 1.28 | 2.927 |

Вариант 19

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2.425 | 4.301 | 1.078 | 4.377 | 4.25 | 3.42 | 0.244 | 4.282 | 3.28 | 0.132 |
| 6.048 | 2.452 | 0.413 | 3.68 | 1.801 | 1.102 | 2.263 | 3.551 | 2.937 | 0.571 |
| 2.932 | 4.061 | 3.523 | 2.254 | 1.637 | 2.186 | 2.01 | 3.035 | 2.795 | 1.751 |
| 1.374 | 0.311 | -1.188 | 0.494 | 4.094 | 4.387 | 1.513 | 3.217 | 2.197 | 1.047 |
| 2.037 | 4.58 | 2.359 | -1.467 | 3.919 | 0.196 | 1.105 | 2.601 | 4.593 | 2.583 |
| 3.113 | 1.333 | 2.474 | 3.502 | 0.338 | 2.433 | 4.222 | 1.787 | 4.94 | 0.453 |
| 2.362 | 1.052 | 3.474 | 1.279 | 1.429 | 1.634 | 1.605 | 3.089 | 2.876 | 2.055 |
| 3.203 | 1.062 | 2.794 | 3.174 | 2.434 | 1.289 | 2.797 | 1.778 | 2.294 | 2.651 |
| 2.592 | 2.863 | 4.444 | 2.085 | 4.226 | 2.605 | 2.35 | 2.47 | 2.595 | 2.312 |
| 3.707 | 3.403 | 3.987 | 3.685 | 2.751 | 3.495 | 4.029 | 2.105 | 4.094 | 2.933 |
| -0.793 | 3.171 | 2.57 | 5.318 | 2.674 | 1.567 | 1.793 | 2.524 | 3.611 | 2.521 |
| 2.189 | 3.736 | 3.465 | 1.901 | 6.768 | 3.565 | 3.214 | 2.284 | 2.891 | 4.755 |
| 3.827 | 6.248 | 1.747 | 4.091 | 4.049 | 2.785 | 4.858 | 0.108 | 1.84 | 3.866 |
| 4.202 | 1.526 | 3.657 | 0.941 | 1.234 | 3.959 | 3.64 | 2.919 | 4.092 | 3.702 |
| 3.103 | 2.231 | 2.773 | 1.213 | 1.859 | 2.727 | 3.782 | 2.378 | 1.924 | 4.065 |
| 3.412 | 2.866 | 2.672 | 1.951 | 5.121 | 4.06 | 1.171 | 2.213 | 4.044 | 4.612 |
| 4.833 | 4.878 | 3.297 | 3.76 | 3.345 | 1.63 | -0.068 | -0.419 | 1.462 | 4.658 |
| 2.145 | 2.209 | 3.403 | 3.761 | 3.084 | 2.172 | 3.47 | 4.035 | 4.197 | 1.121 |

Вариант 20

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3.53 | 6.417 | 1.458 | 6.534 | 6.339 | 5.062 | 0.176 | 6.387 | 4.847 | 2.797e-3 |
| 9.105 | 3.573 | 0.435 | 5.461 | 2.57 | 1.496 | 3.282 | 5.264 | 4.319 | 0.678 |
| 4.311 | 6.047 | 5.219 | 3.267 | 2.318 | 3.163 | 2.892 | 4.469 | 4.1 | 2.494 |
| 1.914 | 0.278 | -2.028 | 0.56 | 6.099 | 6.55 | 2.127 | 4.749 | 3.18 | 1.411 |
| 2.934 | 6.846 | 3.429 | -2.457 | 5.829 | 0.101 | 1.5 | 3.802 | 6.866 | 3.774 |
| 4.59 | 1.851 | 3.606 | 5.188 | 0.319 | 3.543 | 6.295 | 2.55 | 7.401 | 0.496 |
| 3.434 | 1.419 | 5.145 | 1.768 | 1.998 | 2.313 | 2.27 | 4.552 | 4.224 | 2.962 |
| 4.727 | 1.434 | 4.099 | 4.683 | 3.545 | 1.783 | 4.102 | 2.536 | 3.33 | 3.878 |
| 3.788 | 4.204 | 6.638 | 3.007 | 6.301 | 3.808 | 3.415 | 3.6 | 3.793 | 3.357 |
| 5.503 | 5.035 | 5.934 | 5.47 | 4.033 | 5.177 | 5.998 | 3.038 | 6.098 | 4.312 |
| -1.42 | 4.678 | 3.754 | 7.981 | 3.913 | 2.211 | 2.559 | 3.682 | 5.355 | 3.678 |
| 3.167 | 5.547 | 5.132 | 2.724 | 10.213 | 5.285 | 4.745 | 3.313 | 4.247 | 7.115 |

Вариант 21

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4.011 | 7.914 | 4.558 | 2.88 | 3.594 | 4.753 | 3.944 | 4.849 | 4.191 | 5.392 |
| 6.032 | 4.041 | 5.773 | 1.735 | 6.332 | 2.835 | 2.533 | 2.544 | 4.483 | 5.065 |
| 2.561 | 1.845 | 5.194 | 0.12 | 3.94 | 4.064 | 5.141 | 4.409 | 6.186 | 5.694 |
| 6.114 | 5.363 | 3.827 | 1.932 | -0.18 | 5.172 | 2.777 | 4.818 | 3.645 | 5.369 |
| 5.977 | 3.339 | 3.163 | 5.809 | 5.62 | 1.764 | 2.938 | 4.021 | 5.951 | 4.363 |
| 5.083 | 2.587 | 3.754 | 6.125 | 1.611 | 4.02 | 3.159 | 2.788 | 4.206 | 5.164 |
| 1.663 | 3.838 | 3.565 | 3.029 | 2.59 | 5.947 | 3.129 | 4.412 | 3.93 | 5.739 |
| 6.011 | 5.225 | 4.668 | 4.864 | 4.202 | 3.325 | 4.727 | 3.315 | 4.06 | 3.667 |
| 4.933 | 4.563 | 4.41 | 3.766 | 6.346 | 6.721 | 4.497 | 3.871 | 4.195 | 5.809 |
| 1.542 | 2.015 | 3.286 | 2.528 | 4.182 | 1.887 | 3.614 | 4.255 | 3.89 | 4.559 |

Вариант 22

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -1.362 | 0.37 | -2.605 | 0.441 | 0.323 | -0.443 | -3.374 | 0.352 | -0.572 | -3.478 |
| 1.983 | -1.336 | -3.219 | -0.203 | -1.938 | -2.582 | -1.511 | -0.322 | -0.889 | -3.073 |
| -0.893 | 0.148 | -0.348 | -1.52 | -2.089 | -1.582 | -1.745 | -0.799 | -1.02 | -1.983 |
| -2.332 | -3.313 | -4.697 | -3.144 | 0.18 | 0.45 | -2.204 | -0.631 | -1.572 | -2.633 |
| -1.72 | 0.627 | -1.423 | -4.954 | 0.017 | -3.419 | -2.58 | -1.199 | 0.639 | -1.215 |
| -0.726 | -2.37 | -1.316 | -0.367 | -3.288 | -1.354 | 0.297 | -1.95 | 0.96 | -3.182 |
| -1.419 | -2.629 | -0.393 | -2.419 | -2.281 | -2.092 | -2.118 | -0.749 | -0.946 | -1.703 |
| -0.644 | -2.62 | -1.021 | -0.67 | -1.353 | -2.41 | -1.019 | -1.959 | -1.482 | -1.153 |
| -1.207 | -0.957 | 0.503 | -1.676 | 0.301 | -1.195 | -1.431 | -1.32 | -1.204 | -1.466 |
| -0.178 | -0.459 | 0.08 | -0.198 | -1.06 | -0.374 | 0.119 | -1.657 | 0.179 | -0.893 |
| -4.332 | -0.673 | -1.227 | 1.308 | -1.132 | -2.153 | -1.945 | -1.271 | -0.267 | -1.273 |
| -1.58 | -0.152 | -0.401 | -1.846 | 2.648 | -0.309 | -0.633 | -1.492 | -0.932 | 0.789 |

Вариант 23

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -2.67 | 0.217 | -4.742 | 0.334 | 0.139 | -1.138 | -6.024 | 0.187 | -1.353 | -6.197 |
| 2.905 | -2.627 | -5.765 | -0.739 | -3.63 | -4.704 | -2.918 | -0.936 | -1.881 | -5.522 |
| -1.889 | -0.153 | -0.981 | -2.933 | -3.882 | -3.037 | -3.308 | -1.731 | -2.1 | -3.706 |
| -4.286 | -5.922 | -8.228 | -5.64 | -0.101 | 0.35 | -4.073 | -1.451 | -3.02 | -4.789 |
| -3.266 | 0.646 | -2.771 | -8.657 | -0.371 | -6.099 | -4.7 | -2.398 | 0.666 | -2.426 |
| -1.61 | -4.349 | -2.594 | -1.012 | -5.881 | -2.657 | 0.095 | -3.65 | 1.201 | -5.704 |
| -2.766 | -4.781 | -1.055 | -4.432 | -4.202 | -3.887 | -3.93 | -1.648 | -1.976 | -3.238 |
| -1.473 | -4.766 | -2.101 | -1.517 | -2.655 | -4.417 | -2.098 | -3.664 | -2.87 | -2.322 |
| -2.412 | -1.996 | 0.438 | -3.193 | 0.101 | -2.392 | -2.785 | -2.6 | -2.407 | -2.843 |
| -0.697 | -1.165 | -0.266 | -0.73 | -2.167 | -1.023 | -0.202 | -3.162 | -0.102 | -1.888 |
| -7.62 | -1.522 | -2.446 | 1.781 | -2.287 | -3.989 | -3.641 | -2.518 | -0.845 | -2.522 |
| -3.033 | -0.653 | -1.068 | -3.476 | 4.013 | -0.915 | -1.455 | -2.887 | -1.953 | 0.915 |
| -0.513 | 3.212 | -3.713 | -0.106 | -0.171 | -2.115 | 1.074 | -6.234 | -3.57 | -0.452 |
| 0.065 | -4.052 | -0.773 | -4.952 | -4.502 | -0.31 | -0.799 | -1.91 | -0.105 | -0.705 |
| -1.626 | -2.968 | -2.134 | -4.534 | -3.54 | -2.204 | -0.582 | -2.742 | -3.441 | -0.147 |

Вариант 24

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -5.124 | -1.659 | -7.61 | -1.519 | -1.753 | -3.286 | -9.149 | -1.695 | -3.544 | -9.357 |
| 1.566 | -5.073 | -8.837 | -2.806 | -6.275 | -7.565 | -5.421 | -3.043 | -4.177 | -8.547 |
| -4.186 | -2.103 | -3.097 | -5.44 | -6.578 | -5.564 | -5.889 | -3.998 | -4.44 | -6.367 |
| -7.063 | -9.026 | -11.794 | -8.688 | -2.041 | -1.5 | -6.807 | -3.661 | -5.544 | -7.667 |
| -5.84 | -1.145 | -5.245 | -12.309 | -2.366 | -9.239 | -7.56 | -4.797 | -1.121 | -4.831 |
| -3.852 | -7.139 | -5.033 | -3.134 | -8.977 | -5.109 | -1.805 | -6.3 | -0.479 | -8.764 |
| -5.239 | -7.657 | -3.186 | -7.239 | -6.963 | -6.584 | -6.636 | -3.897 | -4.291 | -5.805 |
| -3.688 | -7.64 | -4.441 | -3.74 | -5.106 | -7.22 | -4.437 | -6.317 | -5.365 | -4.706 |
| -4.815 | -4.315 | -1.395 | -5.752 | -1.799 | -4.79 | -5.262 | -5.041 | -4.809 | -5.332 |
| -2.757 | -3.318 | -2.239 | -2.796 | -4.521 | -3.147 | -2.162 | -5.714 | -2.042 | -4.185 |
| -11.064 | -3.746 | -4.855 | 0.217 | -4.664 | -6.707 | -6.29 | -4.941 | -2.934 | -4.946 |
| -5.559 | -2.703 | -3.202 | -6.091 | 2.895 | -3.018 | -3.666 | -5.384 | -4.264 | -0.822 |
| -2.535 | 1.934 | -6.375 | -2.047 | -2.126 | -4.458 | -0.631 | -9.4 | -6.204 | -2.463 |
| -1.842 | -6.782 | -2.848 | -7.862 | -7.322 | -2.292 | -2.879 | -4.211 | -2.046 | -2.766 |
| -3.871 | -5.481 | -4.481 | -7.36 | -6.168 | -4.565 | -2.618 | -5.21 | -6.049 | -2.096 |
| -3.3 | -4.31 | -4.666 | -5.999 | -0.146 | -2.104 | -7.439 | -5.514 | -2.135 | -1.085 |
| -5.124 | -1.659 | -7.61 | -1.519 | -1.753 | -3.286 | -9.149 | -1.695 | -3.544 | -9.357 |
| 1.566 | -5.073 | -8.837 | -2.806 | -6.275 | -7.565 | -5.421 | -3.043 | -4.177 | -8.547 |

Вариант 25

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| -5.805 | 2.558 | -4.633 | -8.229 | -6.7 | -4.215 | -5.948 | -4.009 | -5.418 | -2.846 |
| -1.474 | -5.741 | -2.029 | -10.682 | -0.832 | -8.324 | -8.971 | -8.95 | -4.794 | -3.547 |
| -8.913 | -10.447 | -3.271 | -14.142 | -5.957 | -5.691 | -3.383 | -4.952 | -1.144 | -2.199 |
| -1.299 | -2.908 | -6.199 | -10.26 | -14.786 | -3.318 | -8.449 | -4.075 | -6.589 | -2.895 |
| -1.592 | -7.244 | -7.623 | -1.951 | -2.357 | -10.621 | -8.103 | -5.783 | -1.648 | -5.051 |
| -3.507 | -8.856 | -6.355 | -1.275 | -10.949 | -5.786 | -7.63 | -8.425 | -5.387 | -3.334 |
| -10.836 | -6.177 | -6.762 | -7.909 | -8.85 | -1.657 | -7.695 | -4.947 | -5.978 | -2.103 |
| -1.519 | -3.204 | -4.397 | -3.976 | -5.397 | -7.275 | -4.271 | -7.297 | -5.701 | -6.543 |
| -3.83 | -4.622 | -4.95 | -6.331 | -0.801 | 1.129e-3 | -4.764 | -6.106 | -5.411 | -1.952 |
| -11.096 | -10.083 | -7.358 | -8.984 | -5.438 | -10.355 | -6.657 | -5.283 | -6.065 | -4.632 |