PRACTICAL NUMBER 10 & 11

**Fitting of Normal Distribution (expected normal frequencies)**

**Question 1**: Graphically represent a normal distribution curve when µ=5, σ=1.5.

|  |  |
| --- | --- |
| X | P(X) |
| -2 | 4.96403E-06 |
| -1 | 8.92202E-05 |
| 0 | 0.001028186 |
| 1 | 0.007597324 |
| 2 | 0.035993978 |
| 3 | 0.10934005 |
| 4 | 0.212965337 |
| 5 | 0.26596152 |
| 6 | 0.212965337 |
| 7 | 0.10934005 |
| 8 | 0.035993978 |
| 9 | 0.007597324 |
| 10 | 0.001028186 |
| 11 | 8.92202E-05 |
| 12 | 4.96403E-06 |

|  |  |
| --- | --- |
| X | P(X) |
| -2 | 4.96403E-06 |
| -1.5 | 2.22472E-05 |
| -1 | 8.92202E-05 |
| -0.5 | 0.00032018 |
| 0 | 0.001028186 |
| 0.5 | 0.002954566 |
| 1 | 0.007597324 |
| 1.5 | 0.017481259 |
| 2 | 0.035993978 |
| 2.5 | 0.066318093 |
| 3 | 0.10934005 |
| 3.5 | 0.161313816 |
| 4 | 0.212965337 |
| 4.5 | 0.251588818 |
| 5 | 0.26596152 |
| 5.5 | 0.251588818 |
| 6 | 0.212965337 |
| 6.5 | 0.161313816 |
| 7 | 0.10934005 |
| 7.5 | 0.066318093 |
| 8 | 0.035993978 |
| 8.5 | 0.017481259 |
| 9 | 0.007597324 |
| 9.5 | 0.002954566 |
| 10 | 0.001028186 |
| 10.5 | 0.00032018 |
| 11 | 8.92202E-05 |
| 11.5 | 2.22472E-05 |
| 12 | 4.96403E-06 |

|  |  |
| --- | --- |
| X | P(X) |
| -2 | 4.96403E-06 |
| -1.8 | 9.16646E-06 |
| -1.6 | 1.66283E-05 |
| -1.4 | 2.96329E-05 |
| -1.2 | 5.18775E-05 |
| -1 | 8.92202E-05 |
| -0.8 | 0.000150739 |
| -0.6 | 0.000250189 |
| -0.4 | 0.000407935 |
| -0.2 | 0.000653419 |
| 0 | 0.001028186 |
| 0.2 | 0.001589392 |
| 0.4 | 0.002413624 |
| 0.6 | 0.003600704 |
| 0.8 | 0.005276968 |
| 1 | 0.007597324 |
| 1.2 | 0.010745239 |
| 1.4 | 0.014929687 |
| 1.6 | 0.02037814 |
| 1.8 | 0.027324837 |
| 2 | 0.035993978 |
| 2.2 | 0.046578051 |
| 2.4 | 0.059212307 |
| 2.6 | 0.073947223 |
| 2.8 | 0.090721655 |
| 3 | 0.10934005 |
| 3.2 | 0.12945737 |
| 3.4 | 0.150575218 |
| 3.6 | 0.172051884 |
| 3.8 | 0.193127702 |
| 4 | 0.212965337 |
| 4.2 | 0.230702595 |
| 4.4 | 0.245513427 |
| 4.6 | 0.25667125 |
| 4.8 | 0.263607894 |
| 5 | 0.26596152 |
| 5.2 | 0.263607894 |
| 5.4 | 0.25667125 |
| 5.6 | 0.245513427 |
| 5.8 | 0.230702595 |
| 6 | 0.212965337 |
| 6.2 | 0.193127702 |
| 6.4 | 0.172051884 |
| 6.6 | 0.150575218 |
| 6.8 | 0.12945737 |
| 7 | 0.10934005 |
| 7.2 | 0.090721655 |
| 7.4 | 0.073947223 |
| 7.6 | 0.059212307 |
| 7.8 | 0.046578051 |
| 8 | 0.035993978 |
| 8.2 | 0.027324837 |
| 8.4 | 0.02037814 |
| 8.6 | 0.014929687 |
| 8.8 | 0.010745239 |
| 9 | 0.007597324 |
| 9.2 | 0.005276968 |
| 9.4 | 0.003600704 |
| 9.6 | 0.002413624 |
| 9.8 | 0.001589392 |
| 10 | 0.001028186 |
| 10.2 | 0.000653419 |
| 10.4 | 0.000407935 |
| 10.6 | 0.000250189 |
| 10.8 | 0.000150739 |
| 11 | 8.92202E-05 |
| 11.2 | 5.18775E-05 |
| 11.4 | 2.96329E-05 |
| 11.6 | 1.66283E-05 |
| 11.8 | 9.16646E-06 |
| 12 | 4.96403E-06 |

**Question 2:** Convert the given normal distribution to standard normal distribution.

|  |  |  |  |
| --- | --- | --- | --- |
| X | Z | FI(Z) | P(Z) |
| -2 | -4.66667 | 1.53063E-06 | 1.53063E-06 |
| -1 | -4 | 3.16712E-05 | 3.01406E-05 |
| 0 | -3.33333 | 0.00042906 | 0.000397389 |
| 1 | -2.66667 | 0.003830381 | 0.00340132 |
| 2 | -2 | 0.022750132 | 0.018919751 |
| 3 | -1.33333 | 0.09121122 | 0.068461088 |
| 4 | -0.66667 | 0.252492538 | 0.161281318 |
| 5 | 0 | 0.5 | 0.247507462 |
| 6 | 0.666667 | 0.747507462 | 0.247507462 |
| 7 | 1.333333 | 0.90878878 | 0.161281318 |
| 8 | 2 | 0.977249868 | 0.068461088 |
| 9 | 2.666667 | 0.996169619 | 0.018919751 |
| 10 | 3.333333 | 0.99957094 | 0.00340132 |
| 11 | 4 | 0.999968329 | 0.000397389 |
| 12 | 4.666667 | 0.999998469 | 3.01406E-05 |

|  |  |  |  |
| --- | --- | --- | --- |
| X | Z | FI(Z) | P(Z) |
| -2 | -4.66667 | 1.53063E-06 | 1.53063E-06 |
| -1.5 | -4.33333 | 7.34342E-06 | 5.8128E-06 |
| -1 | -4 | 3.16712E-05 | 2.43278E-05 |
| -0.5 | -3.66667 | 0.000122866 | 9.11951E-05 |
| 0 | -3.33333 | 0.00042906 | 0.000306194 |
| 0.5 | -3 | 0.001349898 | 0.000920838 |
| 1 | -2.66667 | 0.003830381 | 0.002480483 |
| 1.5 | -2.33333 | 0.009815329 | 0.005984948 |
| 2 | -2 | 0.022750132 | 0.012934803 |
| 2.5 | -1.66667 | 0.047790352 | 0.02504022 |
| 3 | -1.33333 | 0.09121122 | 0.043420867 |
| 3.5 | -1 | 0.158655254 | 0.067444034 |
| 4 | -0.66667 | 0.252492538 | 0.093837284 |
| 4.5 | -0.33333 | 0.36944134 | 0.116948803 |
| 5 | 0 | 0.5 | 0.13055866 |
| 5.5 | 0.333333 | 0.63055866 | 0.13055866 |
| 6 | 0.666667 | 0.747507462 | 0.116948803 |
| 6.5 | 1 | 0.841344746 | 0.093837284 |
| 7 | 1.333333 | 0.90878878 | 0.067444034 |
| 7.5 | 1.666667 | 0.952209648 | 0.043420867 |
| 8 | 2 | 0.977249868 | 0.02504022 |
| 8.5 | 2.333333 | 0.990184671 | 0.012934803 |
| 9 | 2.666667 | 0.996169619 | 0.005984948 |
| 9.5 | 3 | 0.998650102 | 0.002480483 |
| 10 | 3.333333 | 0.99957094 | 0.000920838 |
| 10.5 | 3.666667 | 0.999877134 | 0.000306194 |
| 11 | 4 | 0.999968329 | 9.11951E-05 |
| 11.5 | 4.333333 | 0.999992657 | 2.43278E-05 |
| 12 | 4.666667 | 0.999998469 | 5.8128E-06 |

|  |  |  |  |
| --- | --- | --- | --- |
| X | Z | FI(Z) | P(Z) |
| -2 | -4.66667 | 1.53063E-06 | 1.53063E-06 |
| -1.8 | -4.53333 | 2.903E-06 | 1.37238E-06 |
| -1.6 | -4.4 | 5.41254E-06 | 2.50954E-06 |
| -1.4 | -4.26667 | 9.92076E-06 | 4.50822E-06 |
| -1.2 | -4.13333 | 1.7877E-05 | 7.95622E-06 |
| -1 | -4 | 3.16712E-05 | 1.37943E-05 |
| -0.8 | -3.86667 | 5.51665E-05 | 2.34953E-05 |
| -0.6 | -3.73333 | 9.44811E-05 | 3.93146E-05 |
| -0.4 | -3.6 | 0.000159109 | 6.46275E-05 |
| -0.2 | -3.46667 | 0.000263477 | 0.000104369 |
| 0 | -3.33333 | 0.00042906 | 0.000165583 |
| 0.2 | -3.2 | 0.000687138 | 0.000258078 |
| 0.4 | -3.06667 | 0.0010823 | 0.000395163 |
| 0.6 | -2.93333 | 0.001676718 | 0.000594418 |
| 0.8 | -2.8 | 0.00255513 | 0.000878412 |
| 1 | -2.66667 | 0.003830381 | 0.00127525 |
| 1.2 | -2.53333 | 0.005649173 | 0.001818792 |
| 1.4 | -2.4 | 0.008197536 | 0.002548363 |
| 1.6 | -2.26667 | 0.011705298 | 0.003507762 |
| 1.8 | -2.13333 | 0.016448696 | 0.004743398 |
| 2 | -2 | 0.022750132 | 0.006301436 |
| 2.2 | -1.86667 | 0.030974076 | 0.008223944 |
| 2.4 | -1.73333 | 0.04151822 | 0.010544144 |
| 2.6 | -1.6 | 0.054799292 | 0.013281072 |
| 2.8 | -1.46667 | 0.071233377 | 0.016434086 |
| 3 | -1.33333 | 0.09121122 | 0.019977842 |
| 3.2 | -1.2 | 0.11506967 | 0.02385845 |
| 3.4 | -1.06667 | 0.143061192 | 0.027991522 |
| 3.6 | -0.93333 | 0.175323945 | 0.032262753 |
| 3.8 | -0.8 | 0.211855399 | 0.036531454 |
| 4 | -0.66667 | 0.252492538 | 0.040637139 |
| 4.2 | -0.53333 | 0.296901429 | 0.044408891 |
| 4.4 | -0.4 | 0.344578258 | 0.04767683 |
| 4.6 | -0.26667 | 0.39486291 | 0.050284652 |
| 4.8 | -0.13333 | 0.446964883 | 0.052101973 |
| 5 | 1.18E-15 | 0.5 | 0.053035117 |
| 5.2 | 0.133333 | 0.553035117 | 0.053035117 |
| 5.4 | 0.266667 | 0.60513709 | 0.052101973 |
| 5.6 | 0.4 | 0.655421742 | 0.050284652 |
| 5.8 | 0.533333 | 0.703098571 | 0.04767683 |
| 6 | 0.666667 | 0.747507462 | 0.044408891 |
| 6.2 | 0.8 | 0.788144601 | 0.040637139 |
| 6.4 | 0.933333 | 0.824676055 | 0.036531454 |
| 6.6 | 1.066667 | 0.856938808 | 0.032262753 |
| 6.8 | 1.2 | 0.88493033 | 0.027991522 |
| 7 | 1.333333 | 0.90878878 | 0.02385845 |
| 7.2 | 1.466667 | 0.928766623 | 0.019977842 |
| 7.4 | 1.6 | 0.945200708 | 0.016434086 |
| 7.6 | 1.733333 | 0.95848178 | 0.013281072 |
| 7.8 | 1.866667 | 0.969025924 | 0.010544144 |
| 8 | 2 | 0.977249868 | 0.008223944 |
| 8.2 | 2.133333 | 0.983551304 | 0.006301436 |
| 8.4 | 2.266667 | 0.988294702 | 0.004743398 |
| 8.6 | 2.4 | 0.991802464 | 0.003507762 |
| 8.8 | 2.533333 | 0.994350827 | 0.002548363 |
| 9 | 2.666667 | 0.996169619 | 0.001818792 |
| 9.2 | 2.8 | 0.99744487 | 0.00127525 |
| 9.4 | 2.933333 | 0.998323282 | 0.000878412 |
| 9.6 | 3.066667 | 0.9989177 | 0.000594418 |
| 9.8 | 3.2 | 0.999312862 | 0.000395163 |
| 10 | 3.333333 | 0.99957094 | 0.000258078 |
| 10.2 | 3.466667 | 0.999736523 | 0.000165583 |
| 10.4 | 3.6 | 0.999840891 | 0.000104369 |
| 10.6 | 3.733333 | 0.999905519 | 6.46275E-05 |
| 10.8 | 3.866667 | 0.999944833 | 3.93146E-05 |
| 11 | 4 | 0.999968329 | 2.34953E-05 |
| 11.2 | 4.133333 | 0.999982123 | 1.37943E-05 |
| 11.4 | 4.266667 | 0.999990079 | 7.95622E-06 |
| 11.6 | 4.4 | 0.999994587 | 4.50822E-06 |
| 11.8 | 4.533333 | 0.999997097 | 2.50954E-06 |
| 12 | 4.666667 | 0.999998469 | 1.37238E-06 |

**Question 3**: Fit the following normal distribution:

|  |  |
| --- | --- |
| X | F |
| 60-65 | 3 |
| 65-70 | 21 |
| 70-75 | 150 |
| 75-80 | 335 |
| 80-85 | 326 |
| 85-90 | 135 |
| 90-95 | 26 |
| 95-100 | 4 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| X | F | Xi | Di | Ui | fiui | ui^2 | fiui^2 | p(x) | ef |
| 60-65 | 3 | 62.5 | -15 | -3 | -9 | 9 | 27 | 0.000432 | 0.43174 |
| 65-70 | 21 | 67.5 | -10 | -2 | -42 | 4 | 84 | 0.005373 | 5.373062 |
| 70-75 | 150 | 72.5 | -5 | -1 | -150 | 1 | 150 | 0.028766 | 28.76593 |
| 75-80 | 335 | **77.5** | 0 | 0 | 0 | 0 | 0 | 0.066251 | 66.2509 |
| 80-85 | 326 | 82.5 | 5 | 1 | 326 | 1 | 326 | 0.065639 | 65.63901 |
| 85-90 | 135 | 87.5 | 10 | 2 | 270 | 4 | 540 | 0.027976 | 27.97622 |
| 90-95 | 26 | 92.5 | 15 | 3 | 78 | 9 | 234 | 0.005129 | 5.129476 |
| 95-100 | 4 | 97.5 | 20 | 4 | 16 | 16 | 64 | 0.000405 | 0.404589 |
|  | 1000 |  |  |  | 489 |  | 1425 |  |  |

|  |  |
| --- | --- |
| **MEAN=** | 79.945 |
| **SD=** | 5.444904 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | F | Z | fi(z) | P(Z) | ef |
| 60-65 | 3 | -3.20445 | 0.000677 | 0.000677 | 0.676615 |
| 65-70 | 21 | -2.286 | 0.011127 | 0.01045 | 10.45043 |
| 70-75 | 150 | -1.36756 | 0.085725 | 0.074598 | 74.59778 |
| 75-80 | 335 | -0.44912 | 0.326673 | 0.240948 | 240.9483 |
| 80-85 | 326 | 0.469324 | 0.680581 | 0.353908 | 353.9078 |
| 85-90 | 135 | 1.387766 | 0.917396 | 0.236815 | 236.8149 |
| 90-95 | 26 | 2.306209 | 0.989451 | 0.072055 | 72.05461 |
| 95-100 | 4 | 3.224651 | 0.999369 | 0.009919 | 9.918856 |

**Question 4**: Fit the following normal distribution:

|  |  |
| --- | --- |
| X | F |
| 150-160 | 9 |
| 160-170 | 24 |
| 170-180 | 51 |
| 180-190 | 66 |
| 190-200 | 72 |
| 200-210 | 48 |
| 210-220 | 21 |
| 220-230 | 6 |
| 230-240 | 3 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| X | F | Xi | Di | ui | fiui | ui^2 | fiui^2 |
| 150-160 | 9 | 155 | -40 | -4 | -36 | 16 | 144 |
| 160-170 | 24 | 165 | -30 | -3 | -72 | 9 | 216 |
| 170-180 | 51 | 175 | -20 | -2 | -102 | 4 | 204 |
| 180-190 | 66 | 185 | -10 | -1 | -66 | 1 | 66 |
| 190-200 | 72 | **195** | 0 | 0 | 0 | 0 | 0 |
| 200-210 | 48 | 205 | 10 | 1 | 48 | 1 | 48 |
| 210-220 | 21 | 215 | 20 | 2 | 42 | 4 | 84 |
| 220-230 | 6 | 225 | 30 | 3 | 18 | 9 | 54 |
| 230-240 | 3 | 235 | 40 | 4 | 12 | 16 | 48 |
|  | 300 |  |  |  | -156 |  | 864 |

|  |  |
| --- | --- |
| **MEAN=** | 189.8 |
| **SD=** | 16.15426 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | f | z | fi(z) | p(z) | ef |
| 155 | 9 | -2.15423 | 0.015611 | 0.015611 | 4.683315 |
| 165 | 24 | -1.5352 | 0.062368 | 0.046756 | 14.02694 |
| 175 | 51 | -0.91617 | 0.17979 | 0.117422 | 35.22664 |
| 185 | 66 | -0.29714 | 0.383182 | 0.203392 | 61.01759 |
| 195 | 72 | 0.321897 | 0.626234 | 0.243053 | 72.91585 |
| 205 | 48 | 0.940928 | 0.826629 | 0.200395 | 60.11842 |
| 215 | 21 | 1.55996 | 0.940615 | 0.113986 | 34.19584 |
| 225 | 6 | 2.178992 | 0.985334 | 0.044719 | 13.41556 |
| 235 | 3 | 2.798024 | 0.997429 | 0.012095 | 3.628596 |