Applications of the Normal Distribution

Standardizing a Normal Random Variable

$$Z = \frac{X - \mu}{\sigma}$$

The random variable Z is said to have the standard normal distribution with μ = 0, σ = 1

Tables

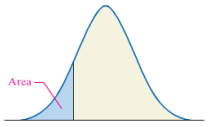

TABLE V

Standard Normal Distribution

z	.00	.01	.02	.03	.04	.05	.06	.07
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011

1. Determine the area under the standard normal curve that lies to the left of: -2.92

TABLE V

Standard Normal Distribution

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026

2. Determine the area under the standard normal curve that lies to the right of: 0.53

TABLE V *(continued)*

Standard Normal Distribution

z	.00	.01	.02	.03	.04	.05
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531

3. Determine the area under the standard normal curve that lies between 0.31 and 0.84

TABLE V *(continued)*

Standard Normal Distribution

z	.00	.01	.02	.03	.04	.05
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531

4. Determine the area under the standard normal curve that lies to the left of -3.32 or to the right of 0.24

TABLE V

z	.00	.01	.02	.03	.04	.05
				Standard Normal Distribution		
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008

TABLE V *(continued)*

z	.00	.01	.02	.03	.04
				Standard Normal	
0.0	0.5000	0.5040	0.5080	0.5120	0.5160
0.1	0.5398	0.5438	0.5478	0.5517	0.5557
0.2	0.5793	0.5832	0.5871	0.5910	0.5948
0.3	0.6179	0.6217	0.6255	0.6293	0.6331
0.4	0.6554	0.6591	0.6628	0.6664	0.6700

5. Find the z-score such that the area under the standard normal curve to the left is 0.7

z	.00	.01	.02	.03	.04	.05	.06
				Standard Normal Distribution			
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764

6. Find the z-score such that the area under the standard normal curve to the right is 0.4

TABLE V *(continued)*

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
					Standard Normal Distribution					
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549

7. Find the z-scores that separate the middle 90% of the distribution from the area in the tails of the standard normal distribution

z	.00	.01	.02	.03	.04	.05
				Standard Normal Distribution		
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495

7. Find the z-scores that separate the middle 90% of the distribution from the area in the tails of the standard normal distribution (cont.)

TABLE V *(continued)*

z	.00	.01	.02	.03	.04	.05	.06
				Standard Normal Distribution			
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515

8. Assume that the random variable X is normally distributed with mean = 30 and standard deviation = 5. Compute the following probabilities. Be sure to draw a normal curve with the area corresponding to the probability shaded.

P(X > 42)

9. Assume that the random variable X is normally distributed with mean = 30 and standard deviation = 5. Compute the following probabilities. Be sure to draw a normal curve with the area corresponding to the probability shaded.

$P(X < 25)$

10. Assume that the random variable X is normally distributed with mean = 30 and standard deviation = 5. Compute the following probabilities. Be sure to draw a normal curve with the area corresponding to the probability shaded.

$P(20 < X < 40)$

11. Assume that the random variable X is normally distributed with mean = 30 and standard deviation = 5. Find each indicated percentile for X

The 15^{th} percentile

Normal Dist: TI-83/84 Functions

- Find the probability, percentage, proportion, or area
  normalcdf(lowerbound,upperbound,μ,σ)
- Find the value
  invnorm(probability, μ,σ)
  probability is always area to left

remember: area = probability

12. Test Scores

Test score are normally distributed with a mean of 65 and a standard deviation of 5:

a) What is the probability of picking a test score out and getting one less than 70
b) What is the probability of picking a test score out and getting one more than 60
c) What is the probability of picking a test score out and getting one between 60 and 80

13. Ages

Ages of Cowley students are normally distributed with a mean of 20 and a standard deviation of 5:

a) What is the probability of picking a student and getting one older than 25
b) What is the probability of picking a student and getting one younger than 16
c) What is the probability of picking a student and getting one between 18 and 20

14. Test Scores

Test score are normally distributed with a mean of 65 and a standard deviation of 5:

a) What is the score that separates the top 10% of the class from the rest?

b) What are the scores that separates the middle 95% of the class from the rest?

Note:

- If you get a certain % that you discard and it asks you how many you need to start making to end up with 5000 after the discards (for example)

total = (start qty) – (start qty)(discard %)

lets say discard % is 0.05 and we want 5000 then:

5000 = s – s(0.05)

5000 = 0.95s

5264 = s