Edexcel Maths S1

Topic Questions from Papers

Mathematical Models

I	_6	2	av	/(2
1	hl	la	n	k	-

6.	(a) Give two reasons to justify the use of statistical models. (2)
	It has been suggested that there are 7 stages involved in creating a statistical model. They are summarised below, with stages 3, 4 and 7 missing.
	Stage 1. The recognition of a real-world problem.
	Stage 2. A statistical model is devised.
	Stage 3.
	Stage 4.
	Stage 5. Comparisons are made against the devised model.
	Stage 6. Statistical concepts are used to test how well the model describes the real-world problem.
	Stage 7.
	(b) Write down the missing stages. (3)

uestion 6 continued	



Statistics S1

Probability

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A \cap B) = P(A) P(B \mid A)$$

$$P(A \mid B) = \frac{P(B \mid A) P(A)}{P(B \mid A) P(A) + P(B \mid A') P(A')}$$

Discrete distributions

For a discrete random variable *X* taking values x_i with probabilities $P(X = x_i)$

Expectation (mean): $E(X) = \mu = \sum x_i P(X = x_i)$

Variance: $Var(X) = \sigma^2 = \sum (x_i - \mu)^2 P(X = x_i) = \sum x_i^2 P(X = x_i) - \mu^2$

For a function g(X): $E(g(X)) = \Sigma g(x_i) P(X = x_i)$

Continuous distributions

Standard continuous distribution:

Distribution of <i>X</i>	P.D.F.	P.D.F. Mean	
Normal $N(\mu, \sigma^2)$	$\frac{1}{\sigma\sqrt{2\pi}}e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$	μ	σ^2

Correlation and regression

For a set of *n* pairs of values (x_i, y_i)

$$S_{xx} = \Sigma (x_i - \overline{x})^2 = \Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}$$

$$S_{yy} = \Sigma (y_i - \overline{y})^2 = \Sigma y_i^2 - \frac{(\Sigma y_i)^2}{n}$$

$$S_{xy} = \Sigma (x_i - \overline{x})(y_i - \overline{y}) = \Sigma x_i y_i - \frac{(\Sigma x_i)(\Sigma y_i)}{n}$$

The product moment correlation coefficient is

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{\Sigma(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\{\Sigma(x_i - \bar{x})^2\}\{\Sigma(y_i - \bar{y})^2\}}} = \frac{\Sigma x_i y_i - \frac{(\Sigma x_i)(\Sigma y_i)}{n}}{\sqrt{\left(\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}\right)\left(\Sigma y_i^2 - \frac{(\Sigma y_i)^2}{n}\right)}}$$

The regression coefficient of y on x is $b = \frac{S_{xy}}{S_{xx}} = \frac{\sum (x_i - \overline{x})(y_i - \overline{y})}{\sum (x_i - \overline{x})^2}$

Least squares regression line of y on x is y = a + bx where $a = \overline{y} - b\overline{x}$

THE NORMAL DISTRIBUTION FUNCTION

The function tabulated below is $\Phi(z)$, defined as $\Phi(z) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z} e^{-\frac{1}{2}t^2} dt$.

0.00 0.5040 0.50 0.6915 1.00 0.8413 1.50 0.9332 2.00 0.9772 0.01 0.5040 0.51 0.6950 1.01 0.8438 1.51 0.9345 2.02 0.9783 0.03 0.5100 0.53 0.7019 1.03 0.8485 1.53 0.9370 2.06 0.9803 0.04 0.5160 0.54 0.7054 1.04 0.8508 1.54 0.9382 2.08 0.9812 0.05 0.5199 0.55 0.7088 1.05 0.8531 1.55 0.9394 2.10 0.9821 0.06 0.5239 0.56 0.7123 1.06 0.8554 1.56 0.9406 2.12 0.9803 0.07 0.5279 0.57 0.7157 1.07 0.8877 1.57 0.9418 2.14 0.9864 0.09 0.5389 0.59 0.7224 1.09 0.8621 1.59 0.9441 2.18 0.9845 0.10 0.5398 <th>z</th> <th>$\Phi(z)$</th> <th>z</th> <th>$\Phi(z)$</th> <th>z</th> <th>$\Phi(z)$</th> <th>z</th> <th>$\Phi(z)$</th> <th>z</th> <th>$\Phi(z)$</th>	z	$\Phi(z)$								
0.01								_ ` '		
0.02 0.5080 0.52 0.6985 1.02 0.8461 1.52 0.9357 2.04 0.9793 0.03 0.5120 0.53 0.7019 1.03 0.8485 1.53 0.9370 2.06 0.9803 0.05 0.5199 0.55 0.7088 1.05 0.8511 1.55 0.9342 2.10 0.9821 0.06 0.5239 0.56 0.7123 1.06 0.8554 1.55 0.9406 2.12 0.9830 0.07 0.5279 0.57 0.7157 1.07 0.8577 1.57 0.9418 2.14 0.9830 0.08 0.5319 0.59 0.7224 1.09 0.8621 1.59 0.9412 2.16 0.9846 0.10 0.5398 0.60 0.7257 1.10 0.8643 1.60 0.9452 2.20 0.9861 0.11 0.5438 0.61 0.7291 1.11 0.8665 1.61 0.9463 2.22 0.9887 0.12 0.5478 <td></td>										
0.03 0.5120 0.53 0.7019 1.03 0.8485 1.54 0.9370 2.06 0.9802 0.04 0.5160 0.54 0.7054 1.06 0.8508 1.54 0.9382 2.08 0.9812 0.05 0.5199 0.55 0.7088 1.05 0.8531 1.55 0.9394 2.10 0.9821 0.06 0.5239 0.56 0.7123 1.06 0.8554 1.56 0.9406 2.12 0.9838 0.08 0.5319 0.58 0.7190 1.08 0.8599 1.58 0.9429 2.16 0.9846 0.09 0.5359 0.59 0.7224 1.09 0.8621 1.59 0.9441 2.18 0.9856 0.10 0.5398 0.60 0.72257 1.10 0.8643 1.60 0.9452 2.20 0.9861 0.10 0.5338 0.61 0.7291 1.11 0.8665 1.61 0.9463 2.22 0.9887 0.12 0.5435 </td <td></td>										
0.04 0.5160 0.54 0.7054 1.04 0.8508 1.55 0.9382 2.08 0.9812 0.05 0.5199 0.55 0.7088 1.05 0.8531 1.55 0.9394 2.10 0.9821 0.07 0.5279 0.57 0.71123 1.06 0.8854 1.56 0.9406 2.12 0.9830 0.07 0.5279 0.57 0.71190 1.08 0.8859 1.58 0.9429 2.16 0.9846 0.09 0.5359 0.7924 1.09 0.8621 1.59 0.9441 2.18 0.9846 0.10 0.5398 0.60 0.7227 1.10 0.8643 1.60 0.9452 2.20 0.9861 0.11 0.5438 0.61 0.7291 1.11 0.8663 1.60 0.9443 2.24 0.9875 0.13 0.5517 0.63 0.7357 1.13 0.8708 1.63 0.9444 2.24 0.9875 0.14 0.5556 0.65<										
0.05 0.5199 0.55 0.7088 1.05 0.8531 1.55 0.9304 2.10 0.9821 0.06 0.5239 0.56 0.7123 1.06 0.8554 1.56 0.9406 2.12 0.9830 0.08 0.5319 0.58 0.7190 1.08 0.8599 1.58 0.9429 2.16 0.9846 0.09 0.5359 0.59 0.7224 1.09 0.8621 1.59 0.9441 2.18 0.9854 0.10 0.5398 0.60 0.7257 1.10 0.8643 1.60 0.9452 2.20 0.9861 0.11 0.5438 0.61 0.7291 1.11 0.8665 1.61 0.9463 2.22 0.9861 0.12 0.5478 0.62 0.7324 1.12 0.8686 1.62 0.9444 2.24 0.9873 0.13 0.5517 0.63 0.7324 1.12 0.8749 1.64 0.9495 2.28 0.9881 0.14 0.5535 <td></td>										
0.06 0.5239 0.56 0.7123 1.06 0.8554 1.56 0.9406 2.12 0.9838 0.07 0.5279 0.57 0.7157 1.07 0.8577 1.57 0.9418 2.14 0.9888 0.08 0.5319 0.58 0.7190 1.08 0.8599 1.58 0.9429 2.16 0.9846 0.10 0.5398 0.60 0.7257 1.10 0.8643 1.60 0.9452 2.20 0.9861 0.11 0.5478 0.62 0.7324 1.11 0.8665 1.61 0.9463 2.22 0.9861 0.12 0.5478 0.62 0.7337 1.13 0.8708 1.63 0.9444 2.24 0.9873 0.13 0.5517 0.63 0.7357 1.13 0.8749 1.65 0.9445 2.22 0.9881 0.14 0.5557 0.64 0.7389 1.14 0.8729 1.64 0.9945 2.28 0.9887 0.15 0.5556 <td></td>										
0.07 0.5279 0.57 0.7157 1.07 0.8579 1.57 0.9418 2.14 0.9836 0.08 0.5319 0.58 0.7190 1.08 0.85599 1.58 0.9429 2.16 0.9846 0.09 0.5359 0.59 0.7224 1.09 0.8621 1.59 0.9441 2.18 0.9846 0.10 0.5398 0.60 0.7257 1.10 0.8643 1.60 0.9452 2.20 0.9861 0.11 0.5438 0.61 0.7291 1.11 0.8665 1.61 0.9463 2.22 0.9868 0.12 0.5478 0.62 0.7324 1.12 0.8666 1.62 0.9484 2.24 0.9875 0.13 0.5517 0.63 0.7385 1.13 0.8708 1.63 0.9484 2.26 0.9881 0.15 0.5536 0.65 0.7422 1.15 0.8749 1.65 0.9505 2.30 0.9898 0.17 0.5636 </td <td></td>										
0.08										
0.09										
0.10									ll	
0.11 0.5438 0.61 0.7291 1.11 0.8665 1.61 0.9463 2.22 0.9868 0.12 0.5478 0.62 0.7324 1.12 0.8686 1.62 0.9474 2.24 0.9875 0.13 0.5517 0.63 0.7357 1.13 0.8708 1.63 0.9484 2.26 0.9881 0.14 0.5557 0.64 0.7389 1.14 0.8729 1.64 0.9495 2.28 0.9881 0.15 0.5596 0.65 0.7422 1.15 0.8749 1.65 0.9505 2.30 0.9893 0.16 0.5636 0.66 0.7454 1.16 0.8770 1.66 0.9515 2.32 0.9898 0.17 0.5675 0.67 0.7486 1.17 0.8790 1.67 0.9525 2.34 0.9904 0.18 0.5714 0.68 0.7517 1.18 0.8810 1.66 0.9545 2.38 0.9910 0.19 0.5353 <td></td>										
0.12 0.5478 0.62 0.7324 1.12 0.8886 1.62 0.9474 2.24 0.9875 0.13 0.5517 0.63 0.7357 1.13 0.8708 1.63 0.9484 2.26 0.9881 0.15 0.5596 0.65 0.7422 1.15 0.8749 1.65 0.9505 2.30 0.9893 0.16 0.5636 0.66 0.7454 1.16 0.8770 1.66 0.9515 2.32 0.9898 0.17 0.5675 0.67 0.7486 1.17 0.8790 1.67 0.9525 2.34 0.9904 0.18 0.5714 0.68 0.7517 1.18 0.8810 1.68 0.9535 2.36 0.9909 0.19 0.5753 0.69 0.7549 1.19 0.8830 1.69 0.9545 2.38 0.9909 0.19 0.5753 0.69 0.7549 1.19 0.8830 1.69 0.9545 2.38 0.9918 0.21 0.5832 <td></td>										
0.13 0.5517 0.63 0.7357 1.13 0.8708 1.63 0.9484 2.26 0.9881 0.14 0.5557 0.64 0.7389 1.14 0.8729 1.64 0.9495 2.28 0.9887 0.15 0.5596 0.65 0.7422 1.15 0.8749 1.65 0.9505 2.30 0.9893 0.16 0.5636 0.66 0.7454 1.16 0.8770 1.66 0.9515 2.32 0.9898 0.17 0.5675 0.67 0.7486 1.17 0.8790 1.67 0.9525 2.34 0.9901 0.18 0.5714 0.68 0.7517 1.18 0.8810 1.66 0.9515 2.32 0.9909 0.19 0.5753 0.69 0.7549 1.19 0.8830 1.69 0.9545 2.38 0.9901 0.21 0.5832 0.71 0.7611 1.21 0.8849 1.70 0.9554 2.40 0.9918 0.22 0.5871 <td></td>										
0.14 0.5557 0.64 0.7389 1.14 0.8729 1.64 0.9495 2.28 0.9893 0.15 0.5596 0.65 0.7422 1.15 0.8749 1.65 0.9505 2.30 0.9893 0.16 0.5636 0.66 0.7454 1.16 0.8770 1.66 0.9515 2.34 0.9904 0.17 0.5675 0.67 0.7486 1.17 0.8790 1.67 0.9525 2.34 0.9904 0.18 0.5714 0.68 0.7517 1.18 0.8810 1.68 0.9535 2.36 0.9909 0.19 0.5753 0.69 0.7549 1.19 0.8830 1.69 0.9545 2.38 0.9913 0.20 0.5793 0.70 0.7580 1.20 0.8849 1.70 0.9554 2.40 0.9918 0.21 0.5832 0.71 0.7611 1.21 0.8869 1.71 0.9564 2.42 0.9922 0.22 0.5871 <td></td>										
0.15 0.5596 0.65 0.7422 1.15 0.8749 1.65 0.9505 2.30 0.9893 0.16 0.5636 0.66 0.7486 1.17 0.8790 1.66 0.9515 2.32 0.9898 0.17 0.5675 0.67 0.7486 1.17 0.8790 1.67 0.9525 2.34 0.9904 0.18 0.57514 0.68 0.7517 1.18 0.8810 1.68 0.9535 2.36 0.9909 0.19 0.5753 0.69 0.7549 1.19 0.8830 1.69 0.9545 2.38 0.9913 0.20 0.5793 0.70 0.7580 1.20 0.8849 1.70 0.9544 2.40 0.9918 0.21 0.5832 0.71 0.7611 1.21 0.8869 1.71 0.9564 2.42 0.9922 0.22 0.5871 0.72 0.7642 1.22 0.8888 1.72 0.9573 2.44 0.9921 0.22 0.5871 </td <td>0.13</td> <td></td> <td>0.63</td> <td></td> <td>1.13</td> <td>0.8708</td> <td>1.63</td> <td>0.9484</td> <td></td> <td>0.9881</td>	0.13		0.63		1.13	0.8708	1.63	0.9484		0.9881
0.16 0.5636 0.66 0.7454 1.16 0.8770 1.66 0.9515 2.32 0.9898 0.17 0.5675 0.67 0.7486 1.17 0.8790 1.67 0.9525 2.34 0.9904 0.18 0.5714 0.68 0.7517 1.18 0.8810 1.68 0.9535 2.36 0.9909 0.19 0.5753 0.69 0.7549 1.19 0.8830 1.69 0.9545 2.38 0.9913 0.20 0.5793 0.70 0.7580 1.20 0.8849 1.70 0.9554 2.40 0.9918 0.21 0.5832 0.71 0.7611 1.21 0.8869 1.71 0.9564 2.42 0.9922 0.22 0.5871 0.72 0.7642 1.22 0.8888 1.72 0.9573 2.44 0.9921 0.23 0.5910 0.73 0.7673 1.23 0.8907 1.73 0.9582 2.46 0.9931 0.24 0.5948 <td>0.14</td> <td>0.5557</td> <td>0.64</td> <td>0.7389</td> <td></td> <td>0.8729</td> <td>1.64</td> <td>0.9495</td> <td></td> <td></td>	0.14	0.5557	0.64	0.7389		0.8729	1.64	0.9495		
0.17 0.5675 0.67 0.7486 1.17 0.8790 1.67 0.9525 2.34 0.9904 0.18 0.5714 0.68 0.7517 1.18 0.8810 1.68 0.9535 2.36 0.9909 0.19 0.5753 0.69 0.7549 1.19 0.8830 1.69 0.9545 2.38 0.9913 0.20 0.5793 0.70 0.7580 1.20 0.8849 1.70 0.9554 2.40 0.9918 0.21 0.5832 0.71 0.7611 1.21 0.8869 1.71 0.9564 2.42 0.9922 0.22 0.5871 0.72 0.7642 1.22 0.8888 1.72 0.9573 2.44 0.9921 0.23 0.5910 0.73 0.7673 1.23 0.8907 1.73 0.9582 2.46 0.9921 0.24 0.5948 0.74 0.7704 1.24 0.8925 1.74 0.9591 2.48 0.9931 0.25 0.5987 <td>0.15</td> <td>0.5596</td> <td>0.65</td> <td>0.7422</td> <td>1.15</td> <td>0.8749</td> <td>1.65</td> <td>0.9505</td> <td>2.30</td> <td>0.9893</td>	0.15	0.5596	0.65	0.7422	1.15	0.8749	1.65	0.9505	2.30	0.9893
0.18 0.5714 0.68 0.7517 1.18 0.8810 1.68 0.9535 2.36 0.9909 0.19 0.5753 0.69 0.7549 1.19 0.8830 1.69 0.9545 2.38 0.9913 0.20 0.5793 0.70 0.7580 1.20 0.8849 1.70 0.9554 2.40 0.9918 0.21 0.5832 0.71 0.7611 1.21 0.8869 1.71 0.9564 2.42 0.9922 0.22 0.5871 0.72 0.7642 1.22 0.8888 1.72 0.9573 2.44 0.9927 0.23 0.5910 0.73 0.7673 1.23 0.8907 1.73 0.9582 2.46 0.9931 0.24 0.5948 0.74 0.7704 1.24 0.8925 1.74 0.9591 2.48 0.9931 0.25 0.6026 0.76 0.7764 1.26 0.8962 1.76 0.9608 2.55 0.9946 0.27 0.6064 <td>0.16</td> <td>0.5636</td> <td>0.66</td> <td>0.7454</td> <td>1.16</td> <td>0.8770</td> <td>1.66</td> <td>0.9515</td> <td>2.32</td> <td>0.9898</td>	0.16	0.5636	0.66	0.7454	1.16	0.8770	1.66	0.9515	2.32	0.9898
0.19 0.5753 0.69 0.7549 1.19 0.8830 1.69 0.9545 2.38 0.9913 0.20 0.5793 0.70 0.7580 1.20 0.8849 1.70 0.9554 2.40 0.9918 0.21 0.5832 0.71 0.7611 1.21 0.8869 1.71 0.9564 2.42 0.9922 0.22 0.5871 0.72 0.7642 1.22 0.8888 1.72 0.9573 2.44 0.9927 0.23 0.5910 0.73 0.7673 1.23 0.8907 1.73 0.9582 2.46 0.9931 0.24 0.5948 0.74 0.7704 1.24 0.8925 1.74 0.9591 2.48 0.9934 0.25 0.5987 0.75 0.7734 1.25 0.8944 1.75 0.9599 2.50 0.9933 0.26 0.6026 0.76 0.7764 1.26 0.8962 1.76 0.9608 2.55 0.9946 0.27 0.6064 <td>0.17</td> <td>0.5675</td> <td>0.67</td> <td>0.7486</td> <td>1.17</td> <td>0.8790</td> <td>1.67</td> <td>0.9525</td> <td>2.34</td> <td>0.9904</td>	0.17	0.5675	0.67	0.7486	1.17	0.8790	1.67	0.9525	2.34	0.9904
0.20 0.5793 0.70 0.7580 1.20 0.8849 1.70 0.9554 2.40 0.9918 0.21 0.5832 0.71 0.7611 1.21 0.8869 1.71 0.9564 2.42 0.9922 0.22 0.5871 0.72 0.7642 1.22 0.8888 1.72 0.9573 2.44 0.9921 0.23 0.5910 0.73 0.7673 1.23 0.8907 1.73 0.9582 2.46 0.9931 0.24 0.5948 0.74 0.7704 1.24 0.8925 1.74 0.9599 2.50 0.9934 0.25 0.5987 0.75 0.7734 1.25 0.8944 1.75 0.9599 2.50 0.9938 0.26 0.6026 0.76 0.7764 1.26 0.8962 1.76 0.9608 2.55 0.9946 0.27 0.6064 0.77 0.7794 1.27 0.8980 1.77 0.9608 2.55 0.9946 0.29 0.6141 <td>0.18</td> <td>0.5714</td> <td>0.68</td> <td></td> <td>1.18</td> <td>0.8810</td> <td>1.68</td> <td>0.9535</td> <td>2.36</td> <td>0.9909</td>	0.18	0.5714	0.68		1.18	0.8810	1.68	0.9535	2.36	0.9909
0.21 0.5832 0.71 0.7611 1.21 0.8869 1.71 0.9564 2.42 0.9922 0.22 0.5871 0.72 0.7642 1.22 0.8888 1.72 0.9573 2.44 0.9927 0.23 0.5910 0.73 0.7673 1.23 0.8907 1.73 0.9582 2.46 0.9931 0.24 0.5948 0.74 0.7704 1.24 0.8925 1.74 0.9591 2.48 0.9934 0.25 0.5987 0.75 0.7734 1.25 0.8944 1.75 0.9599 2.50 0.9938 0.26 0.6026 0.76 0.7764 1.26 0.8962 1.76 0.9608 2.55 0.9946 0.27 0.6064 0.77 0.7794 1.27 0.8980 1.77 0.9616 2.60 0.9953 0.28 0.6103 0.78 0.7823 1.28 0.8997 1.78 0.9625 2.65 0.9960 0.30 0.6179 <td>0.19</td> <td>0.5753</td> <td>0.69</td> <td>0.7549</td> <td>1.19</td> <td>0.8830</td> <td>1.69</td> <td>0.9545</td> <td>2.38</td> <td>0.9913</td>	0.19	0.5753	0.69	0.7549	1.19	0.8830	1.69	0.9545	2.38	0.9913
0.22 0.5871 0.72 0.7642 1.22 0.8888 1.72 0.9573 2.44 0.9927 0.23 0.5910 0.73 0.7673 1.23 0.8907 1.73 0.9582 2.46 0.9931 0.24 0.5948 0.74 0.7704 1.24 0.8925 1.74 0.9591 2.48 0.9934 0.25 0.5987 0.75 0.7734 1.25 0.8944 1.75 0.9599 2.50 0.9938 0.26 0.6026 0.76 0.7764 1.26 0.8962 1.76 0.9608 2.55 0.9948 0.27 0.6064 0.77 0.7794 1.27 0.8980 1.77 0.9616 2.60 0.9953 0.28 0.6103 0.78 0.7823 1.28 0.8997 1.78 0.9625 2.65 0.9960 0.29 0.6141 0.79 0.7852 1.29 0.9015 1.79 0.9633 2.70 0.9965 0.31 0.6217 <td>0.20</td> <td>0.5793</td> <td>0.70</td> <td>0.7580</td> <td>1.20</td> <td>0.8849</td> <td>1.70</td> <td>0.9554</td> <td>2.40</td> <td>0.9918</td>	0.20	0.5793	0.70	0.7580	1.20	0.8849	1.70	0.9554	2.40	0.9918
0.22 0.5871 0.72 0.7642 1.22 0.8888 1.72 0.9573 2.44 0.9927 0.23 0.5910 0.73 0.7673 1.23 0.8907 1.73 0.9582 2.46 0.9931 0.24 0.5948 0.74 0.7704 1.24 0.8925 1.74 0.9591 2.48 0.9934 0.25 0.5987 0.75 0.7734 1.25 0.8944 1.75 0.9599 2.50 0.9938 0.26 0.6026 0.76 0.7764 1.26 0.8962 1.76 0.9608 2.55 0.9948 0.27 0.6064 0.77 0.7794 1.27 0.8980 1.77 0.9616 2.60 0.9953 0.28 0.6103 0.78 0.7823 1.28 0.8997 1.78 0.9625 2.65 0.9960 0.29 0.6141 0.79 0.7852 1.29 0.9015 1.79 0.9633 2.70 0.9965 0.31 0.6217 <td>0.21</td> <td>0.5832</td> <td>0.71</td> <td>0.7611</td> <td>1.21</td> <td>0.8869</td> <td>1.71</td> <td>0.9564</td> <td>2.42</td> <td>0.9922</td>	0.21	0.5832	0.71	0.7611	1.21	0.8869	1.71	0.9564	2.42	0.9922
0.23 0.5910 0.73 0.7673 1.23 0.8907 1.73 0.9582 2.46 0.9931 0.24 0.5948 0.74 0.7704 1.24 0.8925 1.74 0.9591 2.48 0.9934 0.25 0.5987 0.75 0.7734 1.25 0.8944 1.75 0.9599 2.50 0.9938 0.26 0.6026 0.76 0.7764 1.26 0.8962 1.76 0.9608 2.55 0.9946 0.27 0.6064 0.77 0.7794 1.27 0.8980 1.77 0.9616 2.60 0.9953 0.28 0.6103 0.78 0.7823 1.28 0.8997 1.78 0.9625 2.65 0.9960 0.29 0.6141 0.79 0.7882 1.29 0.9015 1.79 0.9633 2.70 0.9965 0.31 0.6217 0.81 0.7910 1.31 0.9049 1.81 0.9644 2.80 0.9974 0.32 0.6255 <td></td>										
0.24 0.5948 0.74 0.7704 1.24 0.8925 1.74 0.9591 2.48 0.9934 0.25 0.5987 0.75 0.7734 1.25 0.8944 1.75 0.9599 2.50 0.9938 0.26 0.6026 0.76 0.7764 1.26 0.8962 1.76 0.9608 2.55 0.9946 0.27 0.6064 0.77 0.7794 1.27 0.8980 1.77 0.9616 2.60 0.9953 0.29 0.6141 0.79 0.7852 1.29 0.9015 1.79 0.9633 2.70 0.9965 0.30 0.6179 0.80 0.7881 1.30 0.9032 1.80 0.9641 2.75 0.9970 0.31 0.6217 0.81 0.7910 1.31 0.9049 1.81 0.9649 2.80 0.9974 0.32 0.6255 0.82 0.7939 1.32 0.9066 1.82 0.9656 2.85 0.9978 0.34 0.6331 <td></td> <td>0.5910</td> <td></td> <td>0.7673</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>		0.5910		0.7673						
0.25 0.5987 0.75 0.7734 1.25 0.8944 1.75 0.9599 2.50 0.9938 0.26 0.6026 0.76 0.7764 1.26 0.8962 1.76 0.9608 2.55 0.9946 0.27 0.6064 0.77 0.7794 1.27 0.8980 1.77 0.9616 2.60 0.9953 0.28 0.6103 0.78 0.7823 1.28 0.8997 1.78 0.9625 2.65 0.9960 0.29 0.6141 0.79 0.7852 1.29 0.9015 1.79 0.9633 2.70 0.9965 0.30 0.6179 0.80 0.7881 1.30 0.9032 1.80 0.9641 2.75 0.9970 0.31 0.6217 0.81 0.7910 1.31 0.9049 1.81 0.9649 2.80 0.9974 0.32 0.6255 0.82 0.7939 1.32 0.9066 1.82 0.9656 2.85 0.9978 0.33 0.6293 <td></td>										
0.26 0.6026 0.76 0.7764 1.26 0.8962 1.76 0.9608 2.55 0.9946 0.27 0.6064 0.77 0.7794 1.27 0.8980 1.77 0.9616 2.60 0.9953 0.28 0.6103 0.78 0.7823 1.28 0.8997 1.78 0.9625 2.65 0.9960 0.29 0.6141 0.79 0.7852 1.29 0.9015 1.79 0.9633 2.70 0.9965 0.30 0.6179 0.80 0.7881 1.30 0.9032 1.80 0.9641 2.75 0.9970 0.31 0.6217 0.81 0.7910 1.31 0.9049 1.81 0.9649 2.80 0.9974 0.32 0.6255 0.82 0.7939 1.32 0.9066 1.82 0.9656 2.85 0.99978 0.33 0.6293 0.83 0.7967 1.33 0.9082 1.83 0.9664 2.90 0.9981 0.34 0.6318 </td <td></td>										
0.27 0.6064 0.77 0.7794 1.27 0.8980 1.77 0.9616 2.60 0.9953 0.28 0.6103 0.78 0.7823 1.28 0.8997 1.78 0.9625 2.65 0.9960 0.29 0.6141 0.79 0.7852 1.29 0.9015 1.79 0.9633 2.70 0.9965 0.30 0.6179 0.80 0.7881 1.30 0.9032 1.80 0.9641 2.75 0.9970 0.31 0.6217 0.81 0.7910 1.31 0.9049 1.81 0.9649 2.80 0.9974 0.32 0.6255 0.82 0.7939 1.32 0.9066 1.82 0.9656 2.85 0.9978 0.33 0.6293 0.83 0.7967 1.33 0.9082 1.83 0.9664 2.90 0.9981 0.34 0.6331 0.84 0.7995 1.34 0.9099 1.84 0.9671 2.95 0.9984 0.35 0.6368 <td></td>										
0.28 0.6103 0.78 0.7823 1.28 0.8997 1.78 0.9625 2.65 0.9960 0.29 0.6141 0.79 0.7852 1.29 0.9015 1.79 0.9633 2.70 0.9965 0.30 0.6179 0.80 0.7881 1.30 0.9032 1.80 0.9641 2.75 0.9970 0.31 0.6217 0.81 0.7910 1.31 0.9049 1.81 0.9649 2.80 0.9974 0.32 0.6255 0.82 0.7939 1.32 0.9066 1.82 0.9656 2.85 0.9978 0.33 0.6293 0.83 0.7967 1.33 0.9082 1.83 0.9664 2.90 0.9981 0.34 0.6331 0.84 0.7995 1.34 0.9099 1.84 0.9671 2.95 0.9984 0.35 0.6368 0.85 0.8023 1.35 0.9115 1.85 0.9678 3.00 0.9987 0.36 0.6406 <td></td>										
0.29 0.6141 0.79 0.7852 1.29 0.9015 1.79 0.9633 2.70 0.9965 0.30 0.6179 0.80 0.7881 1.30 0.9032 1.80 0.9641 2.75 0.9970 0.31 0.6217 0.81 0.7910 1.31 0.9049 1.81 0.9649 2.80 0.9974 0.32 0.6255 0.82 0.7939 1.32 0.9066 1.82 0.9656 2.85 0.9978 0.33 0.6293 0.83 0.7967 1.33 0.9082 1.83 0.9664 2.90 0.9981 0.34 0.6331 0.84 0.7995 1.34 0.9099 1.84 0.9671 2.95 0.9984 0.35 0.6368 0.85 0.8023 1.35 0.9115 1.85 0.9678 3.00 0.9987 0.36 0.6406 0.86 0.8051 1.36 0.9131 1.86 0.9686 3.05 0.9989 0.37 0.6443 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>ll</td> <td></td>									ll	
0.30 0.6179 0.80 0.7881 1.30 0.9032 1.80 0.9641 2.75 0.9970 0.31 0.6217 0.81 0.7910 1.31 0.9049 1.81 0.9649 2.80 0.9974 0.32 0.6255 0.82 0.7939 1.32 0.9066 1.82 0.9656 2.85 0.9978 0.33 0.6293 0.83 0.7967 1.33 0.9082 1.83 0.9664 2.90 0.9981 0.34 0.6331 0.84 0.7995 1.34 0.9099 1.84 0.9671 2.95 0.9984 0.35 0.6368 0.85 0.8023 1.35 0.9115 1.85 0.9678 3.00 0.9987 0.36 0.6406 0.86 0.8051 1.36 0.9131 1.86 0.9686 3.05 0.9989 0.37 0.6443 0.87 0.8078 1.37 0.9147 1.87 0.9693 3.15 0.9992 0.39 0.6517 <td></td>										
0.31 0.6217 0.81 0.7910 1.31 0.9049 1.81 0.9649 2.80 0.9974 0.32 0.6255 0.82 0.7939 1.32 0.9066 1.82 0.9656 2.85 0.9978 0.33 0.6293 0.83 0.7967 1.33 0.9082 1.83 0.9664 2.90 0.9981 0.34 0.6331 0.84 0.7995 1.34 0.9099 1.84 0.9671 2.95 0.9984 0.35 0.6368 0.85 0.8023 1.35 0.9115 1.85 0.9678 3.00 0.9987 0.36 0.6406 0.86 0.8051 1.36 0.9131 1.86 0.9686 3.05 0.9989 0.37 0.6443 0.87 0.8078 1.37 0.9147 1.87 0.9693 3.10 0.9999 0.39 0.6517 0.89 0.8133 1.39 0.9177 1.89 0.9706 3.20 0.9993 0.40 0.6554 <td></td>										
0.32 0.6255 0.82 0.7939 1.32 0.9066 1.82 0.9656 2.85 0.9978 0.33 0.6293 0.83 0.7967 1.33 0.9082 1.83 0.9664 2.90 0.9981 0.34 0.6331 0.84 0.7995 1.34 0.9099 1.84 0.9671 2.95 0.9984 0.35 0.6368 0.85 0.8023 1.35 0.9115 1.85 0.9678 3.00 0.9987 0.36 0.6406 0.86 0.8051 1.36 0.9131 1.86 0.9686 3.05 0.9989 0.37 0.6443 0.87 0.8078 1.37 0.9147 1.87 0.9693 3.10 0.9990 0.38 0.6480 0.88 0.8106 1.38 0.9162 1.88 0.9699 3.15 0.9992 0.39 0.6517 0.89 0.8133 1.39 0.9177 1.89 0.9706 3.20 0.9993 0.41 0.6591 <td></td>										
0.33 0.6293 0.83 0.7967 1.33 0.9082 1.83 0.9664 2.90 0.9981 0.34 0.6331 0.84 0.7995 1.34 0.9099 1.84 0.9671 2.95 0.9984 0.35 0.6368 0.85 0.8023 1.35 0.9115 1.85 0.9678 3.00 0.9987 0.36 0.6406 0.86 0.8051 1.36 0.9131 1.86 0.9686 3.05 0.9989 0.37 0.6443 0.87 0.8078 1.37 0.9147 1.87 0.9693 3.10 0.9990 0.38 0.6480 0.88 0.8106 1.38 0.9162 1.88 0.9699 3.15 0.9992 0.39 0.6517 0.89 0.8133 1.39 0.9177 1.89 0.9706 3.20 0.9993 0.40 0.6554 0.90 0.8159 1.40 0.9192 1.90 0.9713 3.25 0.9994 0.41 0.6591 <td></td>										
0.34 0.6331 0.84 0.7995 1.34 0.9099 1.84 0.9671 2.95 0.9984 0.35 0.6368 0.85 0.8023 1.35 0.9115 1.85 0.9678 3.00 0.9987 0.36 0.6406 0.86 0.8051 1.36 0.9131 1.86 0.9686 3.05 0.9989 0.37 0.6443 0.87 0.8078 1.37 0.9147 1.87 0.9693 3.10 0.9999 0.38 0.6480 0.88 0.8106 1.38 0.9162 1.88 0.9699 3.15 0.9999 0.39 0.6517 0.89 0.8133 1.39 0.9177 1.89 0.9706 3.20 0.9993 0.40 0.6554 0.90 0.8159 1.40 0.9192 1.90 0.9713 3.25 0.9994 0.41 0.6591 0.91 0.8186 1.41 0.9207 1.91 0.9719 3.30 0.9995 0.42 0.6628 <td></td>										
0.35 0.6368 0.85 0.8023 1.35 0.9115 1.85 0.9678 3.00 0.9987 0.36 0.6406 0.86 0.8051 1.36 0.9131 1.86 0.9686 3.05 0.9989 0.37 0.6443 0.87 0.8078 1.37 0.9147 1.87 0.9693 3.10 0.9990 0.38 0.6480 0.88 0.8106 1.38 0.9162 1.88 0.9699 3.15 0.9992 0.39 0.6517 0.89 0.8133 1.39 0.9177 1.89 0.9706 3.20 0.9993 0.40 0.6554 0.90 0.8159 1.40 0.9192 1.90 0.9713 3.25 0.9994 0.41 0.6591 0.91 0.8186 1.41 0.9207 1.91 0.9719 3.30 0.9995 0.42 0.6628 0.92 0.8212 1.42 0.9222 1.92 0.9726 3.35 0.9996 0.43 0.6664 <td></td>										
0.36 0.6406 0.86 0.8051 1.36 0.9131 1.86 0.9686 3.05 0.9989 0.37 0.6443 0.87 0.8078 1.37 0.9147 1.87 0.9693 3.10 0.9990 0.38 0.6480 0.88 0.8106 1.38 0.9162 1.88 0.9699 3.15 0.9992 0.39 0.6517 0.89 0.8133 1.39 0.9177 1.89 0.9706 3.20 0.9993 0.40 0.6554 0.90 0.8159 1.40 0.9192 1.90 0.9713 3.25 0.9994 0.41 0.6591 0.91 0.8186 1.41 0.9207 1.91 0.9719 3.30 0.9995 0.42 0.6628 0.92 0.8212 1.42 0.9222 1.92 0.9726 3.35 0.9996 0.43 0.6664 0.93 0.8238 1.43 0.9236 1.93 0.9732 3.40 0.9997 0.45 0.6736 <td></td>										
0.37 0.6443 0.87 0.8078 1.37 0.9147 1.87 0.9693 3.10 0.9990 0.38 0.6480 0.88 0.8106 1.38 0.9162 1.88 0.9699 3.15 0.9992 0.39 0.6517 0.89 0.8133 1.39 0.9177 1.89 0.9706 3.20 0.9993 0.40 0.6554 0.90 0.8159 1.40 0.9192 1.90 0.9713 3.25 0.9994 0.41 0.6591 0.91 0.8186 1.41 0.9207 1.91 0.9719 3.30 0.9995 0.42 0.6628 0.92 0.8212 1.42 0.9222 1.92 0.9726 3.35 0.9996 0.43 0.6664 0.93 0.8238 1.43 0.9236 1.93 0.9732 3.40 0.9997 0.44 0.6700 0.94 0.8264 1.44 0.9251 1.94 0.9738 3.50 0.9998 0.45 0.6736 <td></td>										
0.38 0.6480 0.88 0.8106 1.38 0.9162 1.88 0.9699 3.15 0.9992 0.39 0.6517 0.89 0.8133 1.39 0.9177 1.89 0.9706 3.20 0.9993 0.40 0.6554 0.90 0.8159 1.40 0.9192 1.90 0.9713 3.25 0.9994 0.41 0.6591 0.91 0.8186 1.41 0.9207 1.91 0.9719 3.30 0.9995 0.42 0.6628 0.92 0.8212 1.42 0.9222 1.92 0.9726 3.35 0.9996 0.43 0.6664 0.93 0.8238 1.43 0.9236 1.93 0.9732 3.40 0.9997 0.44 0.6700 0.94 0.8264 1.44 0.9251 1.94 0.9738 3.50 0.9998 0.45 0.6736 0.95 0.8289 1.45 0.9265 1.95 0.9744 3.60 0.9998 0.46 0.6772 <td></td>										
0.39 0.6517 0.89 0.8133 1.39 0.9177 1.89 0.9706 3.20 0.9993 0.40 0.6554 0.90 0.8159 1.40 0.9192 1.90 0.9713 3.25 0.9994 0.41 0.6591 0.91 0.8186 1.41 0.9207 1.91 0.9719 3.30 0.9995 0.42 0.6628 0.92 0.8212 1.42 0.9222 1.92 0.9726 3.35 0.9996 0.43 0.6664 0.93 0.8238 1.43 0.9236 1.93 0.9732 3.40 0.9997 0.44 0.6700 0.94 0.8264 1.44 0.9251 1.94 0.9738 3.50 0.9998 0.45 0.6736 0.95 0.8289 1.45 0.9265 1.95 0.9744 3.60 0.9998 0.46 0.6772 0.96 0.8315 1.46 0.9279 1.96 0.9750 3.80 0.9999 0.48 0.6844 <td></td>										
0.40 0.6554 0.90 0.8159 1.40 0.9192 1.90 0.9713 3.25 0.9994 0.41 0.6591 0.91 0.8186 1.41 0.9207 1.91 0.9719 3.30 0.9995 0.42 0.6628 0.92 0.8212 1.42 0.9222 1.92 0.9726 3.35 0.9996 0.43 0.6664 0.93 0.8238 1.43 0.9236 1.93 0.9732 3.40 0.9997 0.44 0.6700 0.94 0.8264 1.44 0.9251 1.94 0.9738 3.50 0.9998 0.45 0.6736 0.95 0.8289 1.45 0.9265 1.95 0.9744 3.60 0.9998 0.46 0.6772 0.96 0.8315 1.46 0.9279 1.96 0.9750 3.70 0.9999 0.47 0.6808 0.97 0.8340 1.47 0.9292 1.97 0.9756 3.80 0.9999 0.48 0.6879 <td></td>										
0.41 0.6591 0.91 0.8186 1.41 0.9207 1.91 0.9719 3.30 0.9995 0.42 0.6628 0.92 0.8212 1.42 0.9222 1.92 0.9726 3.35 0.9996 0.43 0.6664 0.93 0.8238 1.43 0.9236 1.93 0.9732 3.40 0.9997 0.44 0.6700 0.94 0.8264 1.44 0.9251 1.94 0.9738 3.50 0.9998 0.45 0.6736 0.95 0.8289 1.45 0.9265 1.95 0.9744 3.60 0.9998 0.46 0.6772 0.96 0.8315 1.46 0.9279 1.96 0.9750 3.70 0.9999 0.47 0.6808 0.97 0.8340 1.47 0.9292 1.97 0.9756 3.80 0.9999 0.48 0.6879 0.99 0.8389 1.49 0.9319 1.99 0.9767 4.00 1.0000										
0.42 0.6628 0.92 0.8212 1.42 0.9222 1.92 0.9726 3.35 0.9996 0.43 0.6664 0.93 0.8238 1.43 0.9236 1.93 0.9732 3.40 0.9997 0.44 0.6700 0.94 0.8264 1.44 0.9251 1.94 0.9738 3.50 0.9998 0.45 0.6736 0.95 0.8289 1.45 0.9265 1.95 0.9744 3.60 0.9998 0.46 0.6772 0.96 0.8315 1.46 0.9279 1.96 0.9750 3.70 0.9999 0.47 0.6808 0.97 0.8340 1.47 0.9292 1.97 0.9756 3.80 0.9999 0.48 0.6844 0.98 0.8365 1.48 0.9306 1.98 0.9761 3.90 1.0000 0.49 0.6879 0.99 0.8389 1.49 0.9319 1.99 0.9767 4.00 1.0000										
0.43 0.6664 0.93 0.8238 1.43 0.9236 1.93 0.9732 3.40 0.9997 0.44 0.6700 0.94 0.8264 1.44 0.9251 1.94 0.9738 3.50 0.9998 0.45 0.6736 0.95 0.8289 1.45 0.9265 1.95 0.9744 3.60 0.9998 0.46 0.6772 0.96 0.8315 1.46 0.9279 1.96 0.9750 3.70 0.9999 0.47 0.6808 0.97 0.8340 1.47 0.9292 1.97 0.9756 3.80 0.9999 0.48 0.6844 0.98 0.8365 1.48 0.9306 1.98 0.9761 3.90 1.0000 0.49 0.6879 0.99 0.8389 1.49 0.9319 1.99 0.9767 4.00 1.0000										
0.44 0.6700 0.94 0.8264 1.44 0.9251 1.94 0.9738 3.50 0.9998 0.45 0.6736 0.95 0.8289 1.45 0.9265 1.95 0.9744 3.60 0.9998 0.46 0.6772 0.96 0.8315 1.46 0.9279 1.96 0.9750 3.70 0.9999 0.47 0.6808 0.97 0.8340 1.47 0.9292 1.97 0.9756 3.80 0.9999 0.48 0.6844 0.98 0.8365 1.48 0.9306 1.98 0.9761 3.90 1.0000 0.49 0.6879 0.99 0.8389 1.49 0.9319 1.99 0.9767 4.00 1.0000										
0.45 0.6736 0.95 0.8289 1.45 0.9265 1.95 0.9744 3.60 0.9998 0.46 0.6772 0.96 0.8315 1.46 0.9279 1.96 0.9750 3.70 0.9999 0.47 0.6808 0.97 0.8340 1.47 0.9292 1.97 0.9756 3.80 0.9999 0.48 0.6844 0.98 0.8365 1.48 0.9306 1.98 0.9761 3.90 1.0000 0.49 0.6879 0.99 0.8389 1.49 0.9319 1.99 0.9767 4.00 1.0000										
0.46 0.6772 0.96 0.8315 1.46 0.9279 1.96 0.9750 3.70 0.9999 0.47 0.6808 0.97 0.8340 1.47 0.9292 1.97 0.9756 3.80 0.9999 0.48 0.6844 0.98 0.8365 1.48 0.9306 1.98 0.9761 3.90 1.0000 0.49 0.6879 0.99 0.8389 1.49 0.9319 1.99 0.9767 4.00 1.0000										
0.47 0.6808 0.97 0.8340 1.47 0.9292 1.97 0.9756 3.80 0.9999 0.48 0.6844 0.98 0.8365 1.48 0.9306 1.98 0.9761 3.90 1.0000 0.49 0.6879 0.99 0.8389 1.49 0.9319 1.99 0.9767 4.00 1.0000										
0.48 0.6844 0.98 0.8365 1.48 0.9306 1.98 0.9761 3.90 1.0000 0.49 0.6879 0.99 0.8389 1.49 0.9319 1.99 0.9767 4.00 1.0000									ll	
0.49										
	0.49	0.6879	1.00	0.8389	1.49	0.9319	2.00	0.9767	4.00	1.0000

PERCENTAGE POINTS OF THE NORMAL DISTRIBUTION

The values z in the table are those which a random variable $Z \sim N(0, 1)$ exceeds with probability p; that is, $P(Z > z) = 1 - \Phi(z) = p$.

р	z	р	z
0.5000	0.0000	0.0500	1.6449
0.4000	0.2533	0.0250	1.9600
0.3000	0.5244	0.0100	2.3263
0.2000	0.8416	0.0050	2.5758
0.1500	1.0364	0.0010	3.0902
0.1000	1.2816	0.0005	3.2905