Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	STATISTICS FOR MANAGEMENT
COURSE CODE	:	BPA 12303
PROGRAMME CODE	:	BPB/BPC/BPP
EXAMINATION DATE	:	JUNE / JULY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS.

THIS QUESTION PAPER CONSISTS OF **TWELVE (12)** PAGES

Q1 (a) At a factory that employs many workers, 30% of the workers are members of the trade union *A*, 60% are members of the trade union *B*, and 10% are not members of any trade union. A sample of five workers are selected from the workers of the factory.

(i) Determine the mean and standard deviation for the number of workers in the sample who are members of *A*.

(5 marks)

(ii) Find the probability that the sample contains not more than 2 members of *A*.

(3 marks)

(b) On average, one out of every 50 bags filled by a machine is underweight.

Find the probability that out of 80 randomly inspected bags, at least one bag is underweight.

(5 marks)

(c) In the production of compact discs at a certain factory, the proportion of faulty discs is known to be 0.2. Each week the factory produces 2000 discs.

Find the probability that there will be at most 349 faulty discs produced in one week.

(7 marks)

Q2 (a) Intelligent Quotients (IQ) in the general population are normally distributed with a mean of 100 and a standard deviation of 15. A random sample of 40 students was taken in a certain university.

(i) Find the probability that the mean IQ of the sample is not more than 109.

(3 marks)

(ii) Find the probability that the mean IQ of the sample is greater than 105 and less than 107.

(3 marks)

(b) A manufacturer of video display units is testing two microcircuit designs to determine whether they produce equivalent mean current flow is normally distributed with mean and standard deviation in **Table Q2**.

Table Q2: Two microcircuit designs

	Design *A*	Design *B*
Sample mean	24.2	23.9
Sample standard deviation	10	20
Sample size	15	10

Find the probability that the mean of Design A is lower than the mean of Design B.
(8 marks)

(c) The operations manager of a large production plant would like to estimate the mean amount of time a worker takes to assemble a new electronic component. Assume that the standard deviation of this assembly time is 3.6 minutes. After observing 120 workers assembling similar devices, the manager noticed that their average time was 16.2minutes.

Construct a 92% confidence interval for the mean assembly time.
(6 marks)

Q3 An engineer conducted a study to determine whether there is a linear relationship between the breaking strength, y of wooden beams and the specific gravity, x of the wood. Ten randomly selected beams of the same cross-sectional dimensions were stressed until they broke. The breaking strength and the specific gravity of the wood are shown in the **Table Q3** for each of the ten beams.

Table Q3: The breaking strength and the specific gravity of the wood

Beam	Breaking strength, y	Specific gravity, x
1	11.14	0.499
2	12.74	0.558
3	13.13	0.604
4	11.51	0.441
5	12.38	0.550
6	12.60	0.528
7	11.13	0.418
8	11.70	0.480
9	11.02	0.406
10	11.41	0.467

(a) Sketch a scatter plot for the data in **Table Q3**.
(4 marks)

(b) Find the estimated regression line by using the least square method.
(6 marks)

(c) Interpret the result in **Q3 (b)**.
(2 marks)

(d) Determine the breaking strength when specific gravity is 0.455.
(2 marks)

(e) Compute the coefficient of correlation, r and coefficient of determination, r^2.
(6 marks)

(f) Interpret these result in **Q3 (e)**.

(2 marks)

Q4 (a) A study to investigate the difference between BMI of men and women was conducted. A random sample of 11 men yield an average BMI of 28.9 and standard deviation of 6.4. A random sample of 13 women yield an average BMI of 26.1 and standard deviation of 4. Assume that the variances are not equal.

Find a 99% confidence interval for the difference between mean BMI for men and women.

(6 marks)

(b) A pharmaceutical manufacturer is concerned about the impurity concentration in batches of drug and is anxious that the mean impurity does not exceed 2.5%. It is known that impurity concentration follows a normal distribution. A random sample of 10 batches had the concentrations as shown in **Table Q4**.

Table Q4: The impurity concentration in batches of drug

Batch	Impurity
1	2.1
2	1.9
3	2.4
4	2.3
5	2.6
6	1.5
7	2.8
8	2.6
9	2.7
10	1.8

Test at a significance level $\alpha = 0.05$ that the population mean concentration is at most 2.5.

(14 marks)

Q5 Susan predicts that students will learn most effectively with a constant background sound, as opposed to an unpredictable sound or no sound at all. She randomly divides fifteen students into three groups of five. All students study a passage of text for 30 minutes. Those in Group 1 study with background sound at a constant volume in the background. Those in Group 2 study with noise that changes volume periodically. Those in Group 3 study with no sound at all. After studying, all students take a 10 point multiple choice tests over the material and the scores are as given in **Table Q5**.

Table Q5: The scores of multiple choice tests

Group 1 Constant Sound	Group 2 Random Sound	Group 3 No Sound
7	5	2
4	5	4
6	3	7
8	4	1
6	4	2

Determine whether there is a significant difference between the groups by using significance level, $\alpha = 0.01$.

(20 marks)

-END OF QUESTIONS-

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2017/2018 PROGRAMME CODE: BPB / BPC / BPP
COURSE NAME : STATISTICS FOR MANAGEMENT COURSE CODE : BPA 12303

Special Probability Distributions

Binomial:

$P(X=x) = {}^{n}C_{x}.p^{x}.q^{n-x}$ Mean, $\mu = np$ Variance, $\sigma^2 = npq$

Poisson:

$$P(X=x) = \frac{e^{-\mu}.\mu^{x}}{x!}$$

Normal:

$$P(X>k) = P\left(Z > \frac{k-\mu}{\sigma}\right)$$

Sampling Distribution

Z – value for single mean:

$$Z = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}}$$

Probability related to single Mean:

$$P\left(\bar{x} > r\right) = P\left(Z > \frac{r-\mu}{\sigma/\sqrt{n}}\right)$$

Let,

$$\mu_{\bar{x}_1-\bar{x}_2} = \mu_1 - \mu_2 \quad and \quad \sigma_{\bar{x}_1-\bar{x}_2} = \sqrt{\frac{\sigma_1^{\,2}}{n_1} + \frac{\sigma_2^{\,2}}{n_2}}$$

Z – value for Two Mean:

$$Z = \frac{\left(\bar{x}_1 - \bar{x}_2\right) - \mu_{\bar{x}_1-\bar{x}_2}}{\sigma_{\bar{x}_1-\bar{x}_2}}$$

Probability related to two Mean:

$$P\left(\bar{x}_1 - \bar{x}_2 > r\right) = P\left(Z > \frac{r-\mu_{\bar{x}_1-\bar{x}_2}}{\sigma_{\bar{x}_1-\bar{x}_2}}\right)$$

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2017/2018 PROGRAMME CODE: BPB / BPC / BPP
COURSE NAME : STATISTICS FOR MANAGEMENT COURSE CODE : BPA 12303

Estimation

Confidence interval for single mean:

Large sample: $n \geq 30$ $\Rightarrow$ σ is known: $\left(\bar{x} - z_{\alpha/2}\left(\sigma/\sqrt{n}\right) < \mu < \bar{x} + z_{\alpha/2}\left(\sigma/\sqrt{n}\right)\right)$

$\Rightarrow$ σ is unknown: $\left(\bar{x} - z_{\alpha/2}\left(s/\sqrt{n}\right) < \mu < \bar{x} + z_{\alpha/2}\left(s/\sqrt{n}\right)\right)$

Small sample: $n < 30$ $\Rightarrow$ σ is unknown: $\left(\bar{x} - t_{\alpha/2}\left(s/\sqrt{n}\right) < \mu < \bar{x} + t_{\alpha/2}\left(s/\sqrt{n}\right)\right)$

Hypothesis Testing

Testing of hypothesis on a difference between two means

Variances	*Samples size*	*Statistical test*
Unknown (Equal)	$n_1, n_2 < 30$	$T_{Test} = \dfrac{\left(\bar{x}_1 - \bar{x}_2\right) - \left(\mu_1 - \mu_2\right)}{S_p \cdot \sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}}$ $v = n_1 + n_2 - 2$ where $S_p = \sqrt{\dfrac{\left(n_1 - 1\right)s_1^{\,2} + \left(n_1 - 1\right)s_2^{\,2}}{n_1 + n_2 - 2}}$
Unknown (Not equal)	$n_1 = n_2 < 30$	$T_{Test} = \dfrac{\left(\bar{x}_1 - \bar{x}_2\right) - \left(\mu_1 - \mu_2\right)}{\sqrt{\dfrac{1}{n}\left(s_1^{\,2} + s_2^{\,2}\right)}}$ $v = 2\left(n - 1\right)$
Unknown (Not equal)	$n_1, n_2 < 30$	$T_{Test} = \dfrac{\left(\bar{x}_1 - \bar{x}_2\right) - \left(\mu_1 - \mu_2\right)}{\sqrt{\dfrac{s_1^{\,2}}{n_1} + \dfrac{s_2^{\,2}}{n_2}}}$ $v = \dfrac{\left(\dfrac{s_1^{\,2}}{n_1} + \dfrac{s_2^{\,2}}{n_2}\right)^2}{\dfrac{\left(\dfrac{s_1^{\,2}}{n_1}\right)^2}{n_1 - 1} + \dfrac{\left(\dfrac{s_2^{\,2}}{n_2}\right)^2}{n_2 - 1}}$

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2017/2018 PROGRAMME CODE: BPB / BPC / BPP
COURSE NAME : STATISTICS FOR MANAGEMENT COURSE CODE : BPA 12303

Simple Linear Regressions

Let

$$S_{xy} = \sum_{i=1}^{n} x_i y_i - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} y_i\right), \qquad S_{xx} = \sum_{i=1}^{n} x_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)^2 \quad \text{and}$$

$$S_{yy} = \sum_{i=1}^{n} y_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} y_i\right)^2$$

Simple linear regression model

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$$

where

$$\hat{\beta}_1 = \frac{S_{xy}}{S_{xx}}$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$$

Coefficient of Determination

$$r^2 = \frac{\left(S_{xy}\right)^2}{S_{xx} \cdot S_{yy}}$$

Coefficient of Pearson Correlation

$$r = \frac{S_{xy}}{\sqrt{S_{xx} \cdot S_{yy}}}$$

Analysis of Variance

Mean square for treatment (between)

$$MS_B = \frac{\sum n_i \left(\bar{x}_i - \bar{x}_{GM}\right)^2}{k-1}$$

Mean square for error (within)

$$MS_W = \frac{\sum \left(n_i - 1\right) s_i^2}{N-k}$$

F test value

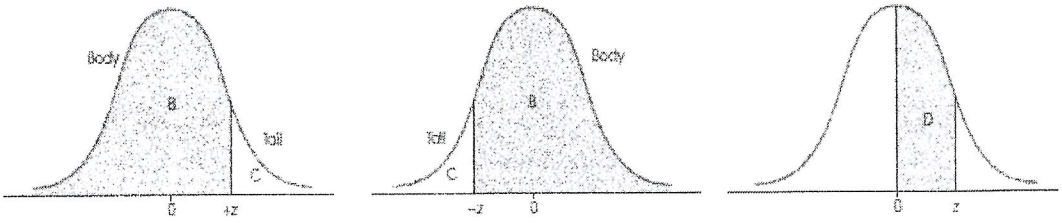
$$F = \frac{MS_B}{MS_W}$$

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2017/2018 PROGRAMME CODE: BPB / BPC / BPP
COURSE NAME : STATISTICS FOR MANAGEMENT COURSE CODE : BPA 12303

The unit Normal table

*Column A lists *z*-score values. A vertical line drawn through a normal distribution at a *z*-score location divides the distribution into two sections.
Column B identifies the proportion in the larger section, called the *body*.
Column C identifies the proportion in the smaller section, called the *tail*.
Column D identifies the proportion between the mean and the *z*-score.
Note: Because the normal distribution is symmetrical, the proportions for negative *z*-scores are the same as those for positive *z*-scores.



(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z	(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z
0.00	.5000	.5000	.0000	0.25	.5987	.4013	.0987
0.01	.5040	.4960	.0040	0.26	.6026	.3974	.1026
0.02	.5080	.4920	.0080	0.27	.6064	.3936	.1064
0.03	.5120	.4880	.0120	0.28	.6103	.3897	.1103
0.04	.5160	.4840	.0160	0.29	.6141	.3859	.1141
0.05	.5199	.4801	.0199	0.30	.6179	.3821	.1179
0.06	.5239	.4761	.0239	0.31	.6217	.3783	.1217
0.07	.5279	.4721	.0279	0.32	.6255	.3745	.1255
0.08	.5319	.4681	.0319	0.33	.6293	.3707	.1293
0.09	.5359	.4641	.0359	0.34	.6331	.3669	.1331
0.10	.5398	.4602	.0398	0.35	.6368	.3632	.1368
0.11	.5438	.4562	.0438	0.36	.6406	.3594	.1406
0.12	.5478	.4522	.0478	0.37	.6443	.3557	.1443
0.13	.5517	.4483	.0517	0.38	.6480	.3520	.1480
0.14	.5557	.4443	.0557	0.39	.6517	.3483	.1517
0.15	.5596	.4404	.0596	0.40	.6554	.3446	.1554
0.16	.5636	.4364	.0636	0.41	.6591	.3409	.1591
0.17	.5675	.4325	.0675	0.42	.6628	.3372	.1628
0.18	.5714	.4286	.0714	0.43	.6664	.3336	.1664
0.19	.5753	.4247	.0753	0.44	.6700	.3300	.1700
0.20	.5793	.4207	.0793	0.45	.6736	.3264	.1736
0.21	.5832	.4168	.0832	0.46	.6772	.3228	.1772
0.22	.5871	.4129	.0871	0.47	.6808	.3192	.1808
0.23	.5910	.4090	.0910	0.48	.6844	.3156	.1844
0.24	.5948	.4052	.0948	0.49	.6879	.3121	.1879

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(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z	(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z
0.50	.6915	.3085	.1915	1.00	.8413	.1587	.3413
0.51	.6950	.3050	.1950	1.01	.8438	.1562	.3438
0.52	.6985	.3015	.1985	1.02	.8461	.1539	.3461
0.53	.7019	.2981	.2019	1.03	.8485	.1515	.3485
0.54	.7054	.2946	.2054	1.04	.8508	.1492	.3508
0.55	.7088	.2912	.2088	1.05	.8531	.1469	.3531
0.56	.7123	.2877	.2123	1.06	.8554	.1446	.3554
0.57	.7157	.2843	.2157	1.07	.8577	.1423	.3577
0.58	.7190	.2810	.2190	1.08	.8599	.1401	.3599
0.59	.7224	.2776	.2224	1.09	.8621	.1379	.3621
0.60	.7257	.2743	.2257	1.10	.8643	.1357	.3643
0.61	.7291	.2709	.2291	1.11	.8665	.1335	.3665
0.62	.7324	.2676	.2324	1.12	.8686	.1314	.3686
0.63	.7357	.2643	.2357	1.13	.8708	.1292	.3708
0.64	.7389	.2611	.2389	1.14	.8729	.1271	.3729
0.65	.7422	.2578	.2422	1.15	.8749	.1251	.3749
0.66	.7454	.2546	.2454	1.16	.8770	.1230	.3770
0.67	.7486	.2514	.2486	1.17	.8790	.1210	.3790
0.68	.7517	.2483	.2517	1.18	.8810	.1190	.3810
0.69	.7549	.2451	.2549	1.19	.8830	.1170	.3830
0.70	.7580	.2420	.2580	1.20	.8849	.1151	.3849
0.71	.7611	.2389	.2611	1.21	.8869	.1131	.3869
0.72	.7642	.2358	.2642	1.22	.8888	.1112	.3888
0.73	.7673	.2327	.2673	1.23	.8907	.1093	.3907
0.74	.7704	.2296	.2704	1.24	.8925	.1075	.3925
0.75	.7734	.2266	.2734	1.25	.8944	.1056	.3944
0.76	.7764	.2236	.2764	1.26	.8962	.1038	.3962
0.77	.7794	.2206	.2794	1.27	.8980	.1020	.3980
0.78	.7823	.2177	.2823	1.28	.8997	.1003	.3997
0.79	.7852	.2148	.2852	1.29	.9015	.0985	.4015
0.80	.7881	.2119	.2881	1.30	.9032	.0968	.4032
0.81	.7910	.2090	.2910	1.31	.9049	.0951	.4049
0.82	.7939	.2061	.2939	1.32	.9066	.0934	.4066
0.83	.7967	.2033	.2967	1.33	.9082	.0918	.4082
0.84	.7995	.2005	.2995	1.34	.9099	.0901	.4099
0.85	.8023	.1977	.3023	1.35	.9115	.0885	.4115
0.86	.8051	.1949	.3051	1.36	.9131	.0869	.4131
0.87	.8078	.1922	.3078	1.37	.9147	.0853	.4147
0.88	.8106	.1894	.3106	1.38	.9162	.0838	.4162
0.89	.8133	.1867	.3133	1.39	.9177	.0823	.4177
0.90	.8159	.1841	.3159	1.40	.9192	.0808	.4192
0.91	.8186	.1814	.3186	1.41	.9207	.0793	.4207
0.92	.8212	.1788	.3212	1.42	.9222	.0778	.4222
0.93	.8238	.1762	.3238	1.43	.9236	.0764	.4236
0.94	.8264	.1736	.3264	1.44	.9251	.0749	.4251
0.95	.8289	.1711	.3289	1.45	.9265	.0735	.4265
0.96	.8315	.1685	.3315	1.46	.9279	.0721	.4279
0.97	.8340	.1660	.3340	1.47	.9292	.0708	.4292
0.98	.8365	.1635	.3365	1.48	.9306	.0694	.4306
0.99	.8389	.1611	.3389	1.49	.9319	.0681	.4319

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SEMESTER / SESSION : SEM II / 2017/2018 PROGRAMME CODE: BPB / BPC / BPP
COURSE NAME : STATISTICS FOR MANAGEMENT COURSE CODE : BPA 12303

(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z	(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z
1.50	.9332	.0668	.4332	2.00	.9772	.0228	.4772
1.51	.9345	.0655	.4345	2.01	.9778	.0222	.4778
1.52	.9357	.0643	.4357	2.02	.9783	.0217	.4783
1.53	.9370	.0630	.4370	2.03	.9788	.0212	.4788
1.54	.9382	.0618	.4382	2.04	.9793	.0207	.4793
1.55	.9394	.0606	.4394	2.05	.9798	.0202	.4798
1.56	.9406	.0594	.4406	2.06	.9803	.0197	.4803
1.57	.9418	.0582	.4418	2.07	.9808	.0192	.4808
1.58	.9429	.0571	.4429	2.08	.9812	.0188	.4812
1.59	.9441	.0559	.4441	2.09	.9817	.0183	.4817
1.60	.9452	.0548	.4452	2.10	.9821	.0179	.4821
1.61	.9463	.0537	.4463	2.11	.9826	.0174	.4826
1.62	.9474	.0526	.4474	2.12	.9830	.0170	.4830
1.63	.9484	.0516	.4484	2.13	.9834	.0166	.4834
1.64	.9495	.0505	.4495	2.14	.9838	.0162	.4838
1.65	.9505	.0495	.4505	2.15	.9842	.0158	.4842
1.66	.9515	.0485	.4515	2.16	.9846	.0154	.4846
1.67	.9525	.0475	.4525	2.17	.9850	.0150	.4850
1.68	.9535	.0465	.4535	2.18	.9854	.0146	.4854
1.69	.9545	.0455	.4545	2.19	.9857	.0143	.4857
1.70	.9554	.0446	.4554	2.20	.9861	.0139	.4861
1.71	.9564	.0436	.4564	2.21	.9864	.0136	.4864
1.72	.9573	.0427	.4573	2.22	.9868	.0132	.4868
1.73	.9582	.0418	.4582	2.23	.9871	.0129	.4871
1.74	.9591	.0409	.4591	2.24	.9875	.0125	.4875
1.75	.9599	.0401	.4599	2.25	.9878	.0122	.4878
1.76	.9608	.0392	.4608	2.26	.9881	.0119	.4881
1.77	.9616	.0384	.4616	2.27	.9884	.0116	.4884
1.78	.9625	.0375	.4625	2.28	.9887	.0113	.4887
1.79	.9633	.0367	.4633	2.29	.9890	.0110	.4890
1.80	.9641	.0359	.4641	2.30	.9893	.0107	.4893
1.81	.9649	.0351	.4649	2.31	.9896	.0104	.4896
1.82	.9656	.0344	.4656	2.32	.9898	.0102	.4898
1.83	.9664	.0336	.4664	2.33	.9901	.0099	.4901
1.84	.9671	.0329	.4671	2.34	.9904	0096	.4904
1.85	.9678	.0322	.4678	2.35	.9906	.0094	.4906
1.86	.9686	.0314	.4686	2.36	.9909	.0091	.4909
1.87	.9693	.0307	.4693	2.37	.9911	.0089	.4911
1.88	.9699	.0301	.4699	2.38	.9913	.0087	.4913
1.89	.9706	.0294	.4706	2.39	.9916	.0084	.4916
1.90	.9713	.0287	.4713	2.40	.9918	.0082	.4918
1.91	.9719	.0281	.4719	2.41	.9920	.0080	.4920
1.92	.9726	.0274	.4726	2.42	.9922	.0078	.4922
1.93	.9732	.0268	.4732	2.43	.9925	.0075	.4925
1.94	.9738	.0262	.4738	2.44	.9927	.0073	.4927
1.95	.9744	.0256	.4744	2.45	.9929	.0071	.4929
1.96	.9750	.0250	.4750	2.46	.9931	.0069	.4931
1.97	.9756	.0244	.4756	2.47	.9932	.0068	.4932
1.98	.9761	.0239	.4761	2.48	.9934	.0066	.4934
1.99	.9767	.0233	.4767	2.49	.9936	.0064	.4936

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(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z
2.50	.9938	.0062	.4938
2.51	.9940	.0060	.4940
2.52	.9941	.0059	.4941
2.53	.9943	.0057	.4943
2.54	.9943	.0055	.4945
2.55	.9946	.0054	.4946
2.56	.9948	.0052	.4948
2.57	.9949	.0051	.4949
2.58	.9951	.0049	.4951
2.59	.9952	.0048	.4952
2.60	.9953	.0047	.4953
2.61	.9955	.0045	.4955
2.62	.9956	.0044	.4956
2.63	.9957	.0043	.4957
2.64	.9959	.0041	.4959
2.65	.9960	.0040	.4960
2.66	.9961	.0039	.4961
2.67	.9962	.0038	.4962
2.68	.9963	.0037	.4963
2.69	.9964	.0036	.4964
2.70	.9965	.0035	.4965
2.71	.9966	.0034	.4966
2.72	.9967	.0033	.4967
2.73	.9968	.0032	.4968
2.74	.9969	.0031	.4969
2.75	.9970	.0030	.4970
2.76	.9971	.0029	.4971
2.77	.9972	.0028	.4972
2.78	.9973	.0027	.4973
2.79	.9974	.0026	.4974
2.80	.9974	.0026	.4974
2.81	.9975	.0025	.4975
2.82	.9976	.0024	.4976
2.83	.9977	.0023	.4977
2.84	.9977	.0023	.4977
2.85	.9978	.0022	.4978
2.86	.9979	.0021	.4979
2.87	.9979	.0021	.4979
2.88	.9980	.0020	.4980
2.89	.9981	.0019	.4981
2.90	.9981	.0019	.4981
2.91	.9982	.0018	.4982
2.92	.9982	.0018	.4982
2.93	.9983	.0017	.4983
2.94	.9984	.0016	.4984
2.95	.9984	.0016	.4984
2.96	.9985	.0015	.4985
2.97	.9985	.0015	.4985
2.98	.9986	.0014	.4986
2.99	.9986	.0014	.4986
3.00	.9987	.0013	.4987
3.01	.9987	.0013	.4987
3.02	.9987	.0013	.4987
3.03	.9988	.0012	.4988
3.04	.9988	.0012	.4988
3.05	.9989	.0011	.4989
3.06	.9989	.0011	.4989
3.07	.9989	.0011	.4989
3.08	.9990	.0010	.4990
3.09	.9990	.0010	.4990
3.10	.9990	.0010	.4990
3.11	.9991	.0009	.4991
3.12	.9991	.0009	.4991
3.13	.9991	.0009	.4991
3.14	.9992	.0008	.4992
3.15	.9992	.0008	.4992
3.16	.9992	.0008	.4992
3.17	.9992	.0008	.4992
3.18	.9993	.0007	.4993
3.19	.9993	.0007	.4993
3.20	.9993	.0007	.4993
3.21	.9993	.0007	.4993
3.22	.9994	.0006	.4994
3.23	.9994	.0006	.4994
3.24	.9994	.0006	.4994
3.30	.9995	.0005	.4995
3.40	.9997	.0003	.4997
3.50	.9998	.0002	.4998
3.60	.9998	.0002	.4998
3.70	.9999	.0001	.4999
3.80	.99993	.00007	.49993
3.90	.99995	.00005	.49995
4.00	.99997	.00003	.49997