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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME : STATISTICS FOR REAL ESTATE MANAGEMENT

COURSE CODE : BPE 15102

PROGRAMME CODE : BPD

EXAMINATION DATE : JUNE 2017

DURATION : 2 HOURS

INSTRUCTION : ANSWER **ALL** QUESTIONS.

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

Q1 (a) A manufacturer of computer chips randomly selects 100 chips from each hour's production. If the probability of a defective is 0.026, find the probability that the number of defectives in the 100 sampled chips is more than 5.

(5 marks)

(b) The number of cars sold by a new car dealer follows a Poisson distribution with a mean of 13.5 cars sold in three days.

(i) Determine the probability that at least 6 cars are sold.

(3 marks)

(ii) Find the mean and standard deviation of Y, the number of cars sold in two days.Calculate the probability that fewer than 10 cars are sold in two days.

(4 marks)

(iii) Find the mean and standard deviation of W, the number of cars sold in four days. Calculate the probability that at most 18 cars are sold in 4 days.

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(4 marks)

(c) A coin is tossed three times. Let the random variable X denotes the number of heads occurring in those three tosses.

(i) Find the expected value of X.

(3 marks)

(ii) Find the variance of X.

(3 marks)

(iii) Find the standard deviation of X.

(3 marks)

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Q2 (a) The mean waiting time for drive-through customers before they get their orders from a fast food restaurant is 20 minutes with standard deviation 5 minutes. If a random sample of 64 customers is observed, what is the probability that their mean waiting time

(i) Is between 18 and 19 minutes.

(3 marks)

(ii) Is more than 12 minutes.

(3 marks)

(iii) At most 19 minutes. (3 marks)

(b) A taxi company purchased two brands of tires, brand A and B. it is known that the mean distance travelled before the tires wear out is 36,300 km for brand A with standard deviation of 200 km while the mean distance travelled before the tires wear out is 36,100 km for brand B with a standard deviation of 300 km. A random sample of 36 tires of brand A and 49 tires of brand B are taken, what is the probability that the

(i) Difference between the mean distance travelled before the tires of brand A and brand B wear out is at most 300 km?

(5 marks)

(ii) Mean distance travelled by tires with brand A is larger than the mean distance travelled by tires with brand B before the tires wear out?

(6 marks)

(iii) Mean distance travelled before the two tires from both brand wear out differ by at most 300km?

(5 marks)

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Q3 (a) The thickness of blue wires produced in factory A is being studied. It is known that the thickness of blue wires normally distributed with standard deviation of 0.001 milimeters. A random sample of 15 blue wire indicated that the mean thickness was 75.08 milimeters. Construct the mean thickness of all blue wires produced in factory A at a 99% confidence interval.

(10 marks)

(b) The following data in **Table Q1** are the number of trainees selected to enter a training program by 9 trainers in Johor and 6 trainers in Kedah over a month.

Table Q1: The number of trainees selected to enter a training program

Johor	50	68	44	78	63	46	69	54	50
Kedah	55	70	62	55	65	56			

Assuming that the two population variances are not equal.

Test that the mean number of trainees in Johor is less than the mean number of trainees in Kedah at 5% significant level.

(15 marks)

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Q4 A semi-conductor industry would like to find out whether worker hours are related to lots sizes. They wish to use the model to later predict the number of worker hours required for different lot sizes. The observed values are given in **Table Q2**.

Table Q2: The number of worker hours for different lot sizes

Lot size	Worker- hours
20	50
20	55
30	73
30	67
40	87
40	95
50	108
50	112
60	128
60	135
70	148
70	160
80	170
80	162

(a) Find the regression coefficients β_0 and β_1 by using the least-squares method.

(15 marks)

(b) Predict the number of worker-hours needed for a lot of size 75.

(2 marks)

(c) Calculate the coefficient of determination, r^2 and coefficient of correlation, r.

(8 marks)

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-END OF QUESTIONS-

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Special Probability Distributions

Binomial:

$$P(X = x) = {}^nC_x \cdot p^x \cdot q^{n-x} \qquad \text{Mean, } \mu = np \qquad \text{Variance, } \sigma^2 = npq$$

Poisson:

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

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:

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

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:

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

Probability related to two Mean:

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

Estimation

Confidence interval for single mean:

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

$\Rightarrow \sigma$ 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: $n < 30 \Rightarrow \sigma$ 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)	$n_1, n_2 < 30$	$T_{Test} = \dfrac{\left(\bar{x}_1 - \bar{x}_2 \right) - \left(\mu_1 - \mu_2 \right)}{\sqrt{\dfrac{s_1^{2}}{n_1} + \dfrac{s_2^{2}}{n_2}}}$ $v = \dfrac{\left(\dfrac{s_1^{2}}{n_1} + \dfrac{s_2^{2}}{n_2} \right)^{2}}{\dfrac{\left(\dfrac{s_1^{2}}{n_1} \right)^{2}}{n_1 - 1} + \dfrac{\left(\dfrac{s_2^{2}}{n_2} \right)^{2}}{n_2 - 1}}$

Simple Linear Regressions

Let

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

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

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

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TABLE B.1   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.
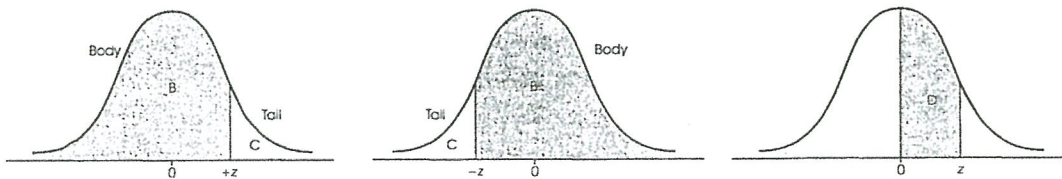
(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z	(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z
0.00	.5000	.5000	.0000	0.25	.5987	.4013	.0987
0.01	.5040	.4960	.0040	0.26	.6026	.3974	.1026
0.02	.5080	.4920	.0080	0.27	.6064	.3936	.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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726   APPENDIX B   STATISTICAL TABLES

(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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(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	(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z
2.50	.9938	.0062	.4938	2.95	.9984	.0016	.4984
2.51	.9940	.0060	.4940	2.96	.9985	.0015	.4985
2.52	.9941	.0059	.4941	2.97	.9985	.0015	.4985
2.53	.9943	.0057	.4943	2.98	.9986	.0014	.4986
2.54	.9945	.0055	.4945	2.99	.9986	.0014	.4986
2.55	.9946	.0054	.4946	3.00	.9987	.0013	.4987
2.56	.9948	.0052	.4948	3.01	.9987	.0013	.4987
2.57	.9949	.0051	.4949	3.02	.9987	.0013	.4987
2.58	.9951	.0049	.4951	3.03	.9988	.0012	.4988
2.59	.9952	.0048	.4952	3.04	.9988	.0012	.4988
2.60	.9953	.0047	.4953	3.05	.9989	.0011	.4989
2.61	.9955	.0045	.4955	3.06	.9989	.0011	.4989
2.62	.9956	.0044	.4956	3.07	.9989	.0011	.4989
2.63	.9957	.0043	.4957	3.08	.9990	.0010	.4990
2.64	.9959	.0041	.4959	3.09	.9990	.0010	.4990
2.65	.9960	.0040	.4960	3.10	.9990	.0010	.4990
2.66	.9961	.0039	.4961	3.11	.9991	.0009	.4991
2.67	.9962	.0038	.4962	3.12	.9991	.0009	.4991
2.68	.9963	.0037	.4963	3.13	.9991	.0009	.4991
2.69	.9964	.0036	.4964	3.14	.9992	.0008	.4992
2.70	.9965	.0035	.4965	3.15	.9992	.0008	.4992
2.71	.9966	.0034	.4966	3.16	.9992	.0008	.4992
2.72	.9967	.0033	.4967	3.17	.9992	.0008	.4992
2.73	.9968	.0032	.4968	3.18	.9993	.0007	.4993
2.74	.9969	.0031	.4969	3.19	.9993	.0007	.4993
2.75	.9970	.0030	.4970	3.20	.9993	.0007	.4993
2.76	.9971	.0029	.4971	3.21	.9993	.0007	.4993
2.77	.9972	.0028	.4972	3.22	.9994	.0006	.4994
2.78	.9973	.0027	.4973	3.23	.9994	.0006	.4994
2.79	.9974	.0026	.4974	3.24	.9994	.0006	.4994
2.80	.9974	.0026	.4974	3.30	.9995	.0005	.4995
2.81	.9975	.0025	.4975	3.40	.9997	.0003	.4997
2.82	.9976	.0024	.4976	3.50	.9998	.0002	.4998
2.83	.9977	.0023	.4977	3.60	.9998	.0002	.4998
2.84	.9977	.0023	.4977	3.70	.9999	.0001	.4999
2.85	.9978	.0022	.4978	3.80	.99993	.00007	.49993
2.86	.9979	.0021	.4979	3.90	.99995	.00005	.49995
2.87	.9979	.0021	.4979	4.00	.99997	.00003	.49997
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				

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