UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	STATISTICS FOR REAL ESTATE MANAGEMENT
COURSE CODE	:	BPE 15102
PROGRAMME	:	BPD
EXAMINATION DATE	:	JUNE/JULY 2018
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS.

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

Q1 (a) There are six car parks along a road. The probability that a car park remains empty at 10 am on particular Sunday is 0.1.

(i) Find the probability that exactly 5 car parks are filled.

(5 marks)

(ii) Compute the probability that at least 2 car parks are empty.

(5 marks)

(b) 1% of the electric bulbs that is produced by a factory are defective. A random sample of 250 electric bulbs are selected.

Find the probability that 3 electric bulbs are defective.

(5 marks)

(c) The height of a door of the library of a certain local university is 1.830m. The heights of the students of the university are normally distributed with a mean of 1.730 m and standard deviation of 0.064 m.

(i) Find the proportion of students that will be taller than the door frame.

(4 marks)

(ii) Find the height of a door frame such that one students in a thousand will be taller than the door frame height.

(3 marks)

(iii) It is known that the female students outnumber the male students in the ratio 6:4 in that university and the proportion of female students taller than the door frame is 0.0162.

Find the proportion of students for whom a door frame of height 1.830 m would be too low.

(3 marks)

Q2 (a) The mass, x of each rubber in a random sample of 50 rubbers from a certain farm is measured in kilograms. It is summarized that $\sum x = 75.5$ and $\sum x^2 = 118.42$.

Calculate the probability that the mean mass of the rubbers is between 1.45 kg and 1.55kg.

(10 marks)

(b) An experiment was performed to compare the wear and tear of rubber shoes produced by Factory *A* and *B*. It is known that the wear and tear of rubber shoes produced by both factories are normally distributed. **Table Q2** shows the necessary data.

Table Q2: The wear and tear of rubber shoes

	Factory *A*	Factory *B*
Sample mean	6	5
Sample standard deviation	1	0.5
Sample size	40	40

Find the probability that the mean of wear and tear shoes produced by Factory *A* is larger than the mean of wear and tear shoes produced by Factory *B*.

(15 marks)

Q3 (a) A machine produces elastic bands with breaking tension normally distributed with mean 45 N and standard deviation 4.36 N. In order to test whether there is a change in the mean breaking tension, a random sample of 50 was tested and found to have a mean breaking tension of 43.46 N.

(i) Construct a 95% confidence interval estimate for the population mean breaking tension based on the sample mean assuming an unchanged standard deviation.

(8 marks)

(ii) The manager of the elastic bands manufacturer claims that there is change in the mean breaking tension.

Justify whether his claim is acceptable or not.

(2 marks)

(b) The measurements of the heat-producing capacity (in millions of calories per ton) of coal specimens from two mines is shown in **Table Q3**. Assume that the populations are normally distributed, with the variances of population are unknown but equal.

Table Q3: The heat-producing capacity of coal specimens

Mine 1	Mine 2
8400	7510
8230	7690
8380	7720
7860	8070
7930	7660

Calculate the test statistics whether the difference between the means of these two samples is significant or not by using a level of significant of 0.05.

(15 marks)

Q4 The large manufacturing company producing air-conditioner compressor believes the number of units of air-conditioner sold is related to atmospheric temperature. A research and development officer conducted a study and gathered the data in **Table Q4.**

Table Q4: The production of air-conditioner compressor

Day	Temperature (°C)	Sale (in thousand units)
1	63	1.52
2	70	1.68
3	73	1.80
4	75	2.05
5	80	2.36
6	82	2.25
7	85	2.68
8	88	2.90
9	90	3.14
10	91	3.06
11	92	3.24
12	75	1.92
13	98	3.40
14	100	3.28

(a) Find the regression coefficients β_0 and β_1 by using the least-squares method. (14 marks)

(b) Predict the number of air-conditioner sold if the temperature soared to 120 °F. (3 marks)

(c) Calculate the coefficient of determination, r and coefficient of correlation, r. (8 marks)

-END OF QUESTIONS-

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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:

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

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

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Simple Linear Regressions

Let

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

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)

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

F test value

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

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The unit Normal table

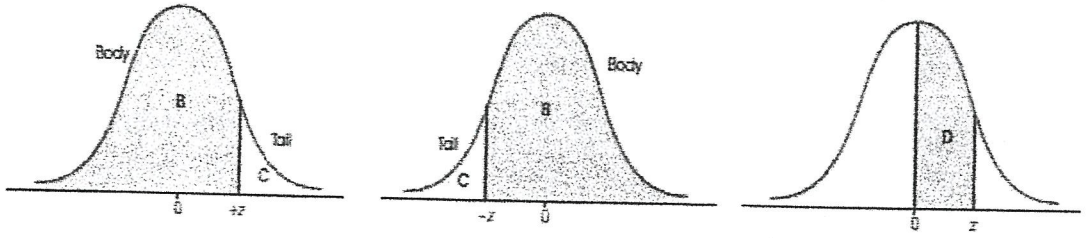
*Column A lists *z*-score values. A vertical line drawn through a normal distribution at a *z*-score location divides the distribution into two sections.

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
0.50	.6915	.3085	.1915
0.51	.6950	.3050	.1950
0.52	.6985	.3015	.1985
0.53	.7019	.2981	.2019
0.54	.7054	.2946	.2054
0.55	.7088	.2912	.2088
0.56	.7123	.2877	.2123
0.57	.7157	.2843	.2157
0.58	.7190	.2810	.2190
0.59	.7224	.2776	.2224
0.60	.7257	.2743	.2257
0.61	.7291	.2709	.2291
0.62	.7324	.2676	.2324
0.63	.7357	.2643	.2357
0.64	.7389	.2611	.2389
0.65	.7422	.2578	.2422
0.66	.7454	.2546	.2454
0.67	.7486	.2514	.2486
0.68	.7517	.2483	.2517
0.69	.7549	.2451	.2549
0.70	.7580	.2420	.2580
0.71	.7611	.2389	.2611
0.72	.7642	.2358	.2642
0.73	.7673	.2327	.2673
0.74	.7704	.2296	.2704
0.75	.7734	.2266	.2734
0.76	.7764	.2236	.2764
0.77	.7794	.2206	.2794
0.78	.7823	.2177	.2823
0.79	.7852	.2148	.2852
0.80	.7881	.2119	.2881
0.81	.7910	.2090	.2910
0.82	.7939	.2061	.2939
0.83	.7967	.2033	.2967
0.84	.7995	.2005	.2995
0.85	.8023	.1977	.3023
0.86	.8051	.1949	.3051
0.87	.8078	.1922	.3078
0.88	.8106	.1894	.3106
0.89	.8133	.1867	.3133
0.90	.8159	.1841	.3159
0.91	.8186	.1814	.3186
0.92	.8212	.1788	.3212
0.93	.8238	.1762	.3238
0.94	.8264	.1736	.3264
0.95	.8289	.1711	.3289
0.96	.8315	.1685	.3315
0.97	.8340	.1660	.3340
0.98	.8365	.1635	.3365
0.99	.8389	.1611	.3389

(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z
1.00	.8413	.1587	.3413
1.01	.8438	.1562	.3438
1.02	.8461	.1539	.3461
1.03	.8485	.1515	.3485
1.04	.8508	.1492	.3508
1.05	.8531	.1469	.3531
1.06	.8554	.1446	.3554
1.07	.8577	.1423	.3577
1.08	.8599	.1401	.3599
1.09	.8621	.1379	.3621
1.10	.8643	.1357	.3643
1.11	.8665	.1335	.3665
1.12	.8686	.1314	.3686
1.13	.8708	.1292	.3708
1.14	.8729	.1271	.3729
1.15	.8749	.1251	.3749
1.16	.8770	.1230	.3770
1.17	.8790	.1210	.3790
1.18	.8810	.1190	.3810
1.19	.8830	.1170	.3830
1.20	.8849	.1151	.3849
1.21	.8869	.1131	.3869
1.22	.8888	.1112	.3888
1.23	.8907	.1093	.3907
1.24	.8925	.1075	.3925
1.25	.8944	.1056	.3944
1.26	.8962	.1038	.3962
1.27	.8980	.1020	.3980
1.28	.8997	.1003	.3997
1.29	.9015	.0985	.4015
1.30	.9032	.0968	.4032
1.31	.9049	.0951	.4049
1.32	.9066	.0934	.4066
1.33	.9082	.0918	.4082
1.34	.9099	.0901	.4099
1.35	.9115	.0885	.4115
1.36	.9131	.0869	.4131
1.37	.9147	.0853	.4147
1.38	.9162	.0838	.4162
1.39	.9177	.0823	.4177
1.40	.9192	.0808	.4192
1.41	.9207	.0793	.4207
1.42	.9222	.0778	.4222
1.43	.9236	.0764	.4236
1.44	.9251	.0749	.4251
1.45	.9265	.0735	.4265
1.46	.9279	.0721	.4279
1.47	.9292	.0708	.4292
1.48	.9306	.0694	.4306
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