KSCP Examination
2020/2021 Academic Session

September 2021

EAA211 – Engineering Mathematics for Civil Engineers

Duration : 2 hours

Please ensure that this examination paper contains **SIX (6)** printed pages before you begin the examination.

Instructions: This paper contains **FOUR (4)** questions. Answer **ALL** questions.

All questions **MUST BE** answered on a new page.

1. (a). In an analysis for the consistency of Portland cement production, the corresponding values of fineness (m^2/kg) and grinding time (hours) are respectively represented by X and ln X as the followings: (300, 2.4771), (304, 2.4829), (305, 2.4843) and (307, 2.4871). Calculate ln (301) by using the Lagrange multiplier method based on the given data.

[10 marks]

(b). Use Newton Algorithm to construct the polynomial interpolation for the set of data given in **Table 1**.

[15 marks]

Table 1

X	0	1	-1	2	-2
Y	-5	-3	-15	39	-9

2. The proposed traffic flow for a road upgrade in Batu Kawan, Pulau Pinang is shown in **Figure 1**. There are four intersections; A, B, C, and D, and the streets are all one-way road where the arrows indicate the direction of traffic flow. The flow of 'traffic in' and 'traffic out' of the network is measured in terms of vehicles per hour (vph). **Figure 1** shows the traffic from 7 am to 9 am on a typical weekday. Assume all traffic entering an intersection must leave that intersection.

   (a). Based on **Figure 1,** construct a set of mathematical models that describes the traffic flow.

   [8 marks]

   (b). Using Gauss Jordan elimination method, solve the mathematical model in (a).

   [17 marks]

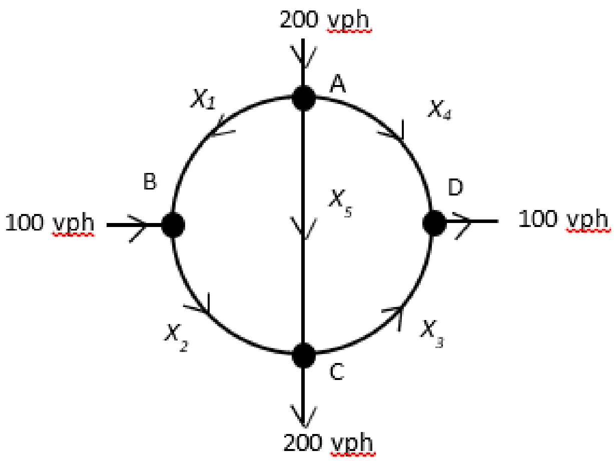


Figure 1

3. (a). Approximate the following integrals:

$$\int_{-0.25}^{0.25} (cosx)^2 \ dx$$

i) by using trapezoidal rule and find the percentage of relative error.

[5 marks]

ii) by using Simpson’s 1/3 rule and find the percentage of relative error.

[5 marks]

iii) Make a conclusion based on answers in (i) and (ii).

[2 marks]

(b).

$$\int_{0}^{\pi} x^2 \cos x \ dx$$

i) Use the multiple-application trapezoidal rule (n=6) to approximate the integrals.

[5 marks]

ii) Use the multiple-application Simpson’s 1/3 rule (n=6) to approximate the integrals.

[8 marks]

4. (a). Three dices are rolled one by one.

   i) Calculate the probability of having the first dice showing “6”.

   [2 marks]

   ii) Calculate the probability of having **AT LEAST ONE** dice showing “6” after all the dices are rolled.

   [4 marks]

   iii) By using conditional probability relation, calculate the probability that the first dice is showing “6” and the sum of all the dices is less or equal to 10.

   [4 marks]

(b). A flow meter is used to measure the flow speed in a river. From past measurements, it is found that the standard deviation of the instrument reading is 0.1 m/s.

Test the hypothesis that the average flow speed in the river is 0.82 m/s, given that the significance level is 10%.

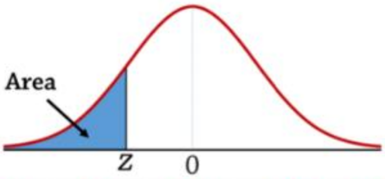
   i) Write the null and alternative hypothesis.

   [4 marks]

   ii) By using the Z-distribution table, determine the confidence interval, and therefore conclude the hypothesis claim.

   [11 marks]

Table 2 : Z-distribution table



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-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
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

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