

# UNIVERSITY OF EMBU

2019/2020 ACADEMIC YEAR

FIRST SEMESTER EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF  
EDUCATION (ARTS)

BMS 211: QUANTITATIVE TECHNIQUES

DATE: JANUARY 16, 2020

TIME: 2:00 PM – 4:00 PM

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions.

QUESTION ONE (30 MARKS)

- a) Explain the meaning of type I and type II Errors and which error is considered more serious (5 marks)
- b) Describe FOUR components of times series (4 marks)
- c) Explain FOUR advantages of probability sampling (4 marks)
- d) Describe the FOUR characteristics of a good measure of dispersion (4 marks)
- e) Explain FOUR advantages of mathematical modelling (4 marks)
- f) Explain FOUR disadvantages of the payback period method of appraising new investments. (4 marks)
- g) A company manufactures two products, X and Y. Each product comprises three materials, in the following quantities per unit of product:

**Raw materials (kg)**

Product	Material A	Material B	Material C
X	0.4	0.2	0.6
Y	0.3	0.5	0.2

Supplies of material A and B in the following period are limited to a maximum of 2,200 kgs and 2,500 kgs respectively. These quantities are insufficient to fully satisfy demand for the two products. There is no limit on the quantity of material C available.



ISO 27001:2013 Certified

*Knowledge Transforms*



ISO 9001:2015 Certified

Selling prices and variable costs of the products are as follows:

Product	Selling price per Unit(Ksh)	Variable cost per Unit(Ksh)
X	10.00	4.50
Y	13.00	7.00

No finished goods stocks are sold

**Required:**

- i) Formulate a linear programming model that could be used to determine the production quantities of each product in the following period so as to maximize profit. (3 marks)
- ii) Use simultaneous equations to determine the optimal production plan in the following period. (2 marks)

**QUESTION TWO (20 MARKS)**

- a) Describe four methods of probability sampling (8 marks)
- b) A company has four production selections  $S_1, S_2, S_3, S_4$  which contribute 30%, 20%, 28% and 22% respectively to the total output. It was observed that these sections respectively produced 1%, 2%, 3% and 4% defective units.

**Required:**

If a unit is selected at random and found to be defective, what is the probability that the unit so selected has come from:

- i) Section two ( $S_2$ ) (6 marks)
- ii) Either section one ( $S_1$ ) or section four ( $S_4$ ). (6 marks)

**QUESTION THREE (20 MARKS)**

- a) Discuss Four importance of time series analysis (6 marks)
- b) The following set of data represents a frequency distribution of customer inquiry in a bank.

No of inquiries	frequency
5-9	4
10-14	10
15-19	17
20-24	20
25-29	22
30-34	16
35-39	8
40-44	3

**Calculate:**

- i) The arithmetic mean. (5 marks)
- ii) The Standard deviation (5 marks)
- iii) Co-efficient of variation (4 marks)



#### **QUESTION FOUR (20 MARKS)**

- a) Describe FOUR limitation of linear programming (4 marks)
- b) In a random sample of 600 men taken from Nairobi city 450 are found to be smokers. In another sample of 900 men taken from Kisumu city 450 are smokers. Do the data reveal significant difference between the two cities so far as the habit of smoking is concerned? Use 5% significance level (6 marks)
- c) Consider the following cash flows of two mutually exclusive projects for JJ Industries. The companies required rate of return is 10%.

<b>Year</b>	<b>Project A</b>	<b>Project B</b>
<b>0</b>	(2000,000)	(1,500,000)
<b>1</b>	1,250,000	1,000,000
<b>2</b>	750,000	1,500,000
<b>3</b>	2,250,000	500,000

#### **Required;**

Evaluate which project should be taken on the basis of the following techniques.

- i) Payback period (3 marks)
- ii) Net present value (4 marks)
- iii) Profitability index (3 marks)

#### **QUESTION FIVE (20 MARKS)**

- a) Differentiate between correlation and regression (6 marks)
- b) A company has a fleet of vehicles and is trying to predict the annual maintenance cost per vehicle. The following data have been supplied for a sample of vehicles.

<b>Vehicle Number</b>	<b>Age in years (x)</b>	<b>Maintenance cost per annum (ksh) (y)</b>
1	2	60
2	8	132
3	6	100
4	8	120
5	10	150
6	4	84
7	4	90
8	2	68
9	6	104
10	10	140



### Required

- i) Using the least square technique, calculate the values of **a** and **b** in the equation  $y = a + bx$ , to allow managers to predict the likely maintenance cost, knowing the age of the vehicle. (8 marks)
- ii) Prepare a table of maintenance cost covering vehicles from 1 to 10 years of age based on your calculation in (i) (4 marks)
- iii) Estimate the maintenance costs of a 12-year-old vehicle and comment on validity of making such an estimate. (2 marks)

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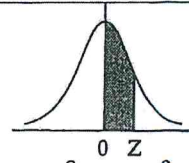




# Statistical and financial tables

**Table 1†**

Areas under the Standard Normal curve from 0 to Z



z	0	1	2	3	4	5	6	7	8	9
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0754
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2258	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2518	0.2549
0.7	0.2580	0.2612	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2996	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

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**Table VII**Present value factors. Present value of £1  $(1 + r)^{-n}$ 

Periods (n)	Interest rates (r)%								
	1%	2%	4%	6%	8%	10%	12%	14%	15%
1	0.990	0.980	0.962	0.943	0.926	0.909	0.893	0.877	0.870
2	0.980	0.961	0.925	0.890	0.857	0.826	0.797	0.769	0.756
3	0.971	0.942	0.889	0.840	0.794	0.751	0.712	0.675	0.658
4	0.961	0.924	0.855	0.792	0.735	0.683	0.636	0.592	0.572
5	0.951	0.906	0.822	0.747	0.681	0.621	0.567	0.519	0.497
6	0.942	0.888	0.790	0.705	0.630	0.564	0.507	0.456	0.432
7	0.933	0.871	0.760	0.665	0.583	0.513	0.452	0.400	0.376
8	0.923	0.853	0.731	0.627	0.540	0.467	0.404	0.351	0.327
9	0.914	0.837	0.703	0.592	0.500	0.424	0.361	0.308	0.284
10	0.905	0.820	0.676	0.558	0.463	0.386	0.322	0.270	0.247
11	0.896	0.804	0.650	0.527	0.429	0.350	0.287	0.237	0.215
12	0.887	0.788	0.625	0.497	0.397	0.319	0.257	0.208	0.187
13	0.879	0.773	0.601	0.469	0.368	0.290	0.229	0.182	0.163
14	0.870	0.758	0.577	0.442	0.340	0.263	0.205	0.160	0.141
15	0.861	0.743	0.555	0.417	0.315	0.239	0.183	0.140	0.123
16	0.853	0.728	0.534	0.394	0.292	0.218	0.163	0.123	0.107
17	0.855	0.714	0.513	0.371	0.270	0.198	0.146	0.108	0.093
18	0.836	0.700	0.494	0.350	0.250	0.180	0.130	0.095	0.081
19	0.828	0.686	0.475	0.331	0.232	0.164	0.116	0.083	0.070
20	0.820	0.675	0.456	0.312	0.215	0.149	0.104	0.073	0.061
21	0.811	0.660	0.439	0.294	0.199	0.135	0.093	0.064	0.053
22	0.803	0.647	0.422	0.278	0.184	0.123	0.083	0.056	0.046
23	0.795	0.634	0.406	0.262	0.170	0.112	0.074	0.049	0.040
24	0.788	0.622	0.390	0.247	0.158	0.102	0.066	0.043	0.035
25	0.780	0.610	0.375	0.233	0.146	0.092	0.059	0.038	0.030

Periods (n)	Interest rates (r)%								
	16%	18%	20%	22%	24%	25%	26%	28%	30%
1	0.862	0.847	0.833	0.820	0.806	0.800	0.794	0.781	0.769
2	0.743	0.718	0.694	0.672	0.650	0.640	0.630	0.610	0.592
3	0.641	0.609	0.579	0.551	0.524	0.512	0.500	0.477	0.455
4	0.552	0.516	0.482	0.451	0.423	0.410	0.397	0.373	0.350
5	0.476	0.437	0.402	0.370	0.341	0.328	0.315	0.291	0.269
6	0.410	0.370	0.335	0.303	0.275	0.262	0.250	0.227	0.207
7	0.354	0.314	0.279	0.249	0.222	0.210	0.198	0.178	0.159
8	0.305	0.266	0.233	0.204	0.179	0.168	0.157	0.139	0.123
9	0.263	0.225	0.194	0.167	0.144	0.134	0.125	0.108	0.094
10	0.227	0.191	0.162	0.137	0.116	0.107	0.099	0.085	0.075
11	0.195	0.162	0.135	0.112	0.094	0.086	0.079	0.066	0.056
12	0.168	0.137	0.112	0.092	0.076	0.069	0.062	0.052	0.043
13	0.145	0.116	0.093	0.075	0.061	0.055	0.050	0.040	0.033
14	0.125	0.099	0.078	0.062	0.049	0.044	0.039	0.032	0.025
15	0.108	0.084	0.065	0.051	0.040	0.035	0.031	0.025	0.020
16	0.093	0.071	0.054	0.042	0.032	0.028	0.025	0.019	0.015
17	0.080	0.060	0.045	0.034	0.026	0.023	0.020	0.015	0.012
18	0.069	0.051	0.038	0.028	0.021	0.018	0.016	0.012	0.009
19	0.060	0.043	0.031	0.023	0.017	0.014	0.012	0.009	0.007
20	0.051	0.037	0.026	0.019	0.014	0.012	0.010	0.007	0.005
21	0.044	0.031	0.022	0.015	0.011	0.009	0.008	0.006	0.004
22	0.038	0.026	0.018	0.013	0.009	0.007	0.006	0.004	0.003
23	0.033	0.022	0.015	0.010	0.007	0.006	0.005	0.003	0.002
24	0.028	0.019	0.011	0.008	0.006	0.005	0.004	0.003	0.002
25	0.024	0.016	0.010	0.007	0.005	0.004	0.003	0.002	0.001



**Table VIII**

Present value annuity factors.

 Present value of £1 received annually for n years  $\left(\frac{1 - (1 + r)^{-n}}{r}\right)$ 

Periods (n)	Interest rates (r) %								
	1%	2%	4%	6%	8%	10%	12%	14%	15%
1	0.990	0.980	0.962	0.943	0.926	0.909	0.893	0.877	0.870
2	1.970	1.942	1.886	1.833	1.783	1.736	1.690	1.647	1.626
3	2.941	2.884	2.775	2.675	2.577	2.487	2.402	2.322	2.283
4	3.902	3.808	3.610	3.465	3.312	3.170	3.037	2.914	2.855
5	4.853	4.713	4.452	4.212	3.996	3.791	3.605	3.433	3.352
6	5.795	5.601	5.242	4.917	4.623	4.355	4.111	3.889	3.784
7	6.728	6.472	6.002	5.582	5.206	4.868	4.564	4.288	4.160
8	7.652	7.325	6.733	6.210	5.747	5.335	4.968	4.639	4.487
9	8.566	8.162	7.435	6.802	6.247	5.759	5.328	4.946	4.772
10	9.471	8.983	8.111	7.360	6.710	6.145	5.650	5.216	5.019
11	10.368	9.787	8.760	7.887	7.139	6.495	5.988	5.453	5.234
12	11.255	10.575	9.385	8.384	7.536	6.814	6.194	5.660	5.421
13	12.114	11.343	9.986	8.853	7.904	7.103	6.424	5.842	5.583
14	13.004	12.106	10.563	9.295	8.244	7.367	6.628	6.002	5.724
15	13.865	12.849	11.118	9.712	8.559	7.606	6.811	6.142	5.847
16	14.718	13.578	11.652	10.106	8.851	7.824	6.974	6.265	5.954
17	15.562	14.292	12.166	10.477	9.122	8.022	7.120	6.373	6.047
18	16.328	14.992	12.659	10.828	9.372	8.201	7.250	6.467	6.128
19	17.226	15.678	13.134	11.158	9.604	8.365	7.366	6.550	6.198
20	18.046	16.351	13.590	11.470	9.818	8.514	7.469	6.623	6.259
21	18.857	17.011	14.029	11.764	10.017	8.649	7.562	6.687	6.312
22	19.660	17.658	14.451	12.042	10.201	8.772	7.645	6.743	6.369
23	20.456	18.292	14.857	12.303	10.371	8.883	7.718	6.792	6.399
24	21.243	18.914	15.247	12.550	10.529	8.985	7.784	6.815	6.434
25	22.023	19.523	15.622	12.783	10.675	9.077	7.843	6.873	6.464

Periods (n)	Interest rates (r)%								
	16%	18%	20%	22%	24%	25%	26%	28%	30%
1	0.862	0.847	0.833	0.820	0.806	0.800	0.794	0.781	0.769
2	1.605	1.566	1.528	1.492	1.457	1.440	1.424	1.392	1.361
3	2.246	2.174	2.106	2.042	1.981	1.952	1.923	1.868	1.816
4	2.798	2.690	2.589	2.494	2.404	2.362	2.320	2.241	2.166
5	3.274	3.127	2.991	2.864	2.745	2.689	2.635	2.532	2.436
6	3.685	3.498	3.326	3.167	3.020	2.951	2.885	2.759	2.643
7	4.039	3.812	3.605	3.416	3.242	3.161	3.083	2.937	2.802
8	4.344	4.078	3.837	3.619	3.421	3.329	3.241	3.076	2.925
9	4.607	4.303	4.031	3.786	3.566	3.463	3.366	3.184	3.019
10	4.833	4.949	4.192	3.923	3.682	3.571	3.465	3.269	3.092
11	5.029	4.636	4.327	4.035	3.766	3.656	3.544	3.335	3.147
12	5.197	4.793	4.439	4.127	3.851	3.725	3.606	3.387	3.190
13	5.342	4.910	4.533	4.203	3.912	3.780	3.656	3.427	3.223
14	5.468	5.008	4.611	4.265	3.961	3.824	3.695	3.459	3.249
15	5.575	5.092	4.675	4.315	4.001	3.859	3.726	3.483	3.268
16	5.669	5.162	4.730	4.357	4.033	3.887	3.751	3.503	3.283
17	5.749	5.222	4.775	4.391	4.059	3.910	3.771	3.518	3.295
18	5.818	5.273	4.812	4.419	4.080	3.928	3.786	3.529	3.304
19	5.877	5.316	4.844	4.442	4.097	3.942	3.799	3.539	3.311
20	5.929	5.353	4.870	4.460	4.110	3.954	3.808	3.546	3.316
21	5.973	5.384	4.891	4.476	4.121	3.963	3.816	3.551	3.320
22	6.011	5.410	4.909	4.488	4.130	3.970	3.822	3.556	3.323
23	6.044	5.432	4.925	4.499	4.137	3.976	3.827	3.559	3.325
24	6.073	5.451	4.937	4.507	4.143	3.981	3.831	3.562	3.327
25	6.097	5.467	4.948	4.514	4.147	3.985	3.834	3.564	3.329

