THE OPEN UNIVERSITY OF SRI LANKA
Department of Civil Engineering
Post Graduate Diploma in Technology - Construction Management - Level 7

CEX7107/CEP2107/CEE7107 – Construction Productivity & Quantitative Techniques

FINAL EXAMINATION - 2006

Time Allowed: Three Hours

Date: 2007 - 03 – 19 (Monday) Time: 0930 - 1230 hrs

Answer Four (04) questions with Two (02) from each section.

SECTION A - CONSTRUCTION PRODUCTIVITY

Q1.

i.) Clearly differentiate between Remuneration and Incentives. Discuss, the *three (03)* broad areas of classification of incentives with rationale for application to different groups of employees.

(08 marks)

ii.) Discuss the advantages and disadvantages of following three financial incentive schemes when applied to workers engaged in highway construction work.

i.) Piecework schemes ii.) Hours saved schemes iii.) Group schemes

(08 marks)

iii.) As a Construction Project Engineer attending a project meeting, several important issues should be clarified in your mind and a few strategic steps have to be planned in advance so as to turn the meeting to your advantage and improve the productivity. Identify and describe these issues and strategic steps.

(09 marks)

Q2.

i.) Describe the basic stages in carrying out a method study and discuss the usage of Multiple Activity Charts in this process.

(08 marks)

ii.) Describe the procedure involved in Work Measurement (Time Study) with particular reference to "rating" as defined in BS 3138. Specifically discuss the factors affecting the rating for typical construction operations.

(08 marks)

iii.) Discuss the advantages of Activity Sampling in productivity evaluation of construction work in the light of convenience, economy, speed and validity of the method.

(09 marks)

Q3.

i.) Productivity of Construction Project Managers is significantly undermined by situations that can be described as **'Time Robbers'**. Briefly describe *ten (10)* of most significant such situations that can arise in the local context.

(08 marks)

ii.) Over the duration of a project, the Project Manager has to engage many times in the process of negotiation. Define the term **"negotiation"** and explain its importance. Prepare a list of guidelines for the process to be effective.

(08 marks)

iii.) Describe and discuss the bearing of following factors related to personnel, on construction productivity;

a.) Stress b.) Energy cycle

(09 marks)

SECTION B – QUANTITATIVE TECHNIQUES

Q4. A computer store purchases network cards from one of the two distributors *A* and *B*. Amount of defectives in the supply by *A* is about 2%, while with *B* it is about 3%. A lot of 1000 network cards consist of about 60% supplied by *A*. From this lot of 1000 network cards, a batch of 20 network cards is randomly selected for inspection.

i.) Compute the probability of finding defective network card.
(05 marks)

ii.) Estimate the expected number of defective network cards out of the 20 cards inspected.
(05 marks)

iii.) What is the probability that all 20 network cards inspected are in good condition?
(05 marks)

iv.) What is the probability of finding at least one defective network card from the batch of 20?.
(05 marks)

v.) Suppose the store can earn a profit of Rs. 150/- from each of the network cards in good condition and the loss from each of the defective network card is Rs. 50/-. Estimate the net profit for the computer store from the lot of 1000 network cards.
(05 marks)

Q5.

The life times of CFL bulbs manufactured by a certain company are normally distributed with an average life of 8000 hours and a standard deviation of 800 hours.

i.) What percentage of CFL bulbs could be expected to have a lifetime of more than 9000 hours?
(08 marks)

ii.) If a batch of 100 randomly chosen CFL bulbs is inspected, estimate the number of bulbs that will last more than 8800 hours.
(08 marks)

iii.) What life time limits would you expect to contain central 90% of CFL bulbs?
(09 marks)

Q6. A cement manufacturing company claims that the new blended cement they have developed gives higher compressive strength in concrete as compared to OPC cements available in the market. The 28 day compressive strength (MPa) of 20 concrete cubes made out of the new blended cement according to a given mix proportion are given below, which could be assumed to be normally distributed. From the past experiments, it is known that for the particular mix proportion the 28 day mean compressive strength of cubes with OPC cements is 60 MPa.

59	61	53	64	57	59	62	61	57	57
56	64	64	62	61	63	58	59	59	60

i. Give an estimate for the mean compressive strength with the new cement.
(03 marks)

ii. Clearly state the null and the alternative hypotheses you would test to examine the validity of the cement manufacturer's claim, stating whether these are one sided or two sided hypotheses.
(05 marks)

iii. Suggest a test statistic that can be used to test the validity of the hypothesis stated in part (ii).
(05 marks)

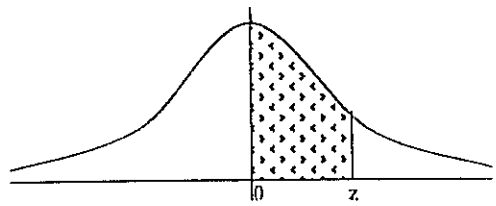
iv. Test the hypothesis stated in part (ii) using a 5% level of significance and clearly state your conclusions.
(07 marks)

v. Will you still use the statistic stated in part (iv), if the population variance of the cube strengths of the new cement is known to be 20 MPa? If not, suggest the changes.
(05 marks)

PQ369

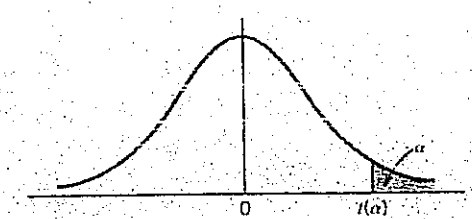
Standard Normal Distribution

Areas under the Standard Normal Curve
form 0 to z for various values of z



z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	0	0.004	0.008	0.012	0.016	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	0.091	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	0.148	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.17	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	0.219	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	0.437	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	0.475	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	0.483	0.4834	0.4838	0.4842	0.4846	0.485	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	0.496	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.497	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	0.498	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	0.49995	0.49995	0.49996	0.49996	0.49996	0.49996	0.49996	0.49996	0.49997	0.49997
4.0	0.49997									
4.5	0.49999									
5.0	0.49999									

Student's t Distribution



df	$t(.005)$	$t(.01)$	$t(.025)$	$t(.05)$	$t(.10)$	$t(.25)$
1	63.657	31.821	12.706	6.314	3.078	1.000
2	9.925	6.965	4.303	2.920	1.886	0.816
3	5.841	4.541	3.182	2.353	1.638	.765
4	4.604	3.747	2.776	2.132	1.533	.741
5	4.032	3.365	2.571	2.015	1.476	0.727
6	3.707	3.143	2.447	1.943	1.440	.718
7	3.499	2.998	2.365	1.895	1.415	.711
8	3.355	2.896	2.306	1.860	1.397	.706
9	3.250	2.821	2.262	1.833	1.383	.703
10	3.169	2.764	2.228	1.812	1.372	0.700
11	3.106	2.718	2.201	1.796	1.363	.697
12	3.055	2.681	2.179	1.782	1.356	.695
13	3.012	2.650	2.160	1.771	1.350	.694
14	2.977	2.624	2.145	1.761	1.345	.692
15	2.947	2.602	2.131	1.753	1.341	0.691
16	2.921	2.583	2.120	1.746	1.337	.690
17	2.898	2.567	2.110	1.740	1.333	.689
18	2.878	2.552	2.101	1.734	1.330	.688
19	2.861	2.539	2.093	1.729	1.328	.688
20	2.845	2.528	2.086	1.725	1.325	0.687
21	2.831	2.518	2.080	1.721	1.323	.686
22	2.819	2.508	2.074	1.717	1.321	.686
23	2.807	2.500	2.069	1.714	1.319	.685
24	2.797	2.492	2.064	1.711	1.318	.685
25	2.787	2.485	2.060	1.708	1.316	0.684
26	2.779	2.479	2.056	1.706	1.315	.684
27	2.771	2.473	2.052	1.703	1.314	.684
28	2.763	2.467	2.048	1.701	1.313	.683
29	2.756	2.462	2.045	1.699	1.311	.683
Large	2.576	2.326	1.960	1.645	1.282	.674