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

CEX7107 – Construction Productivity & Quantitative Techniques

FINAL EXAMINATION – 2010/2011

Time Allowed: Three Hours

Date: 2011 - 03 - 15 (Tuesday) Time: 0930 - 1230 hrs

Answer Four (04) questions.

Section A - Construction Productivity

Q1.

i.) Clearly identify *five (05)* significant factors that could affect the Productivity of a construction site and describe them.

(08 marks)

ii.) A Construction Project Engineer attending as the Chairman at a project meeting has to keep several important issues clarified and a few strategic steps planned in advance so as to make the outcome of the meeting advantages to the project and improve the productivity. Identify and describe these issues and strategic steps.

(08 marks)

iii.) Discuss differences between **Remuneration** and **Incentives** and compare the advantages and disadvantages of following **three** financial incentive schemes applied to workers engaged in road construction work.

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

(09 marks)

Q2.

i.) 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)

ii.) Describe in detail the basic stages involved in carrying out a method study and discuss the utility of Multiple Activity Charts in the process.

(08 marks)

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

(09 marks)

Q3.

i.) The process of negotiation is an important part of construction management. Define the term **"negotiation"** and explain its importance. Prepare a of list guidelines for the process to be effective.

(08 marks)

ii.) Productivity of people involved in any endeavour, is greatly influenced by **physiological** as well as **psychological** aspects related to human beings. Describe and discuss the bearing of following factors, on construction productivity;

a.) Stress condition/level of the person concerned
b.) Energy cycle of the individual

(08 marks)

iii.) **"Time Robbers"** are identified as the situations, which retard the productivity of a person or, a group of people engaged in a particular activity. List *ten (10)* of the most significant time robbers that hinder the productivity of Construction project managers as applicable to the Sri Lankan context.

(09 marks)

Section B – Quantitative Techniques

Q4. Diagonal lengths (in cm) of 30 porcelain tiles randomly selected from a batch are given below.

20.0	20.2	19.9	20.4	19.8	20.1	20.1	20.2	20.3	19.9	19.7	19.6	19.3	19.5	19.2
19.7	19.9	20.3	20.2	19.8	19.8	20.3	20.6	20.4	19.9	19.8	20.2	20.3	20.4	20.5

i.) Compute the sample mean of the tile dimension and interpret it.

(04 marks)

ii.) Compute the sample median of the diagonal lengths.

(04 marks)

iii.) Compare the advantages & disadvantages of the measures of location computed in parts i.) and ii.).

(04 marks)

iv.) Compute the sample variance of the tile dimension.

(04 marks)

v.) Compute the mean absolute deviation of the dimension of the tiles and interpret it.

(04 marks)

vi.) Compare the advantages & disadvantages of the measures of dispersion found in parts iv.) and v.).

(05 marks)

Q5. An aluminum fabricator purchases door locks from two manufacturers *A* and *B*. From past experience it is known that the amount of defectives from the manufacturer *A* is 2.5%, while from *B* it is 3%. A lot of 1000 locks purchased consist of 65% supplied by *A*. (In the following calculations you should round-off your answers to 3 decimal places)

i.) Compute the probability of a randomly selected lock from the Lot being defective.

(05 marks)

ii.) If a randomly selected lock was found to be defective, what is the probability that the lock was supplied by *A*?

(05 marks)

iii.) Estimate the expected number of defective locks in the Lot.

(05 marks)

iv.) From this Lot, five locks are randomly selected for inspection;
a.) What is the probability that all five locks are in good condition?
b.) What is the probability that the last inspected lock is the only defective lock?

(05 marks)

v.) If the fabricator make profits of Rs. 200/- from each good lock by *A* and Rs. 220/- from each good lock by *B* while loosing Rs. 100/- from each defective lock by *A* and Rs. 90/- from each defective lock by *B*, estimate the his net profit from the Lot of 1000 locks.

(05 marks)

Q6. A cement manufacturing company claims that the limestone blended cement they have developed recently 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 and standard deviation is 3 MPa.

63	60	64	70	69	64	65	68	70	55
55	67	58	59	60	56	69	62	56	44

i.) (a) Estimate the mean & standard deviation for compressive strength with the new cement.
(b) What do you think about the manufacturers comment? Breafly discuss your answer.

(07 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.).

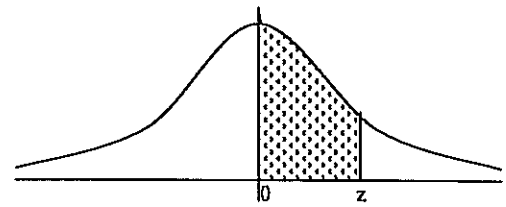
(05 marks)

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

(08 marks)

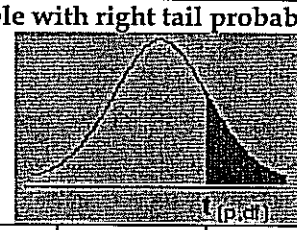
Standard Normal Distribution

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									

t table with right tail probabilities



df\p	0.40	0.25	0.10	0.05	0.025	0.01	0.005	0.0005
1	0.324920	1.000000	3.077684	6.313752	12.70620	31.82052	63.65674	636.6192
2	0.288675	0.816497	1.885618	2.919986	4.30265	6.96456	9.92484	31.5991
3	0.276671	0.764892	1.637744	2.353363	3.18245	4.54070	5.84091	12.9240
4	0.270722	0.740697	1.533206	2.131847	2.77645	3.74695	4.60409	8.6103
5	0.267181	0.726687	1.475884	2.015048	2.57058	3.36493	4.03214	6.8688
6	0.264835	0.717558	1.439756	1.943180	2.44691	3.14267	3.70743	5.9588
7	0.263167	0.711142	1.414924	1.894579	2.36462	2.99795	3.49948	5.4079
8	0.261921	0.706387	1.396815	1.859548	2.30600	2.89646	3.35539	5.0413
9	0.260955	0.702722	1.383029	1.833113	2.26216	2.82144	3.24984	4.7809
10	0.260185	0.699812	1.372184	1.812461	2.22814	2.76377	3.16927	4.5869
11	0.259556	0.697445	1.363430	1.795885	2.20099	2.71808	3.10581	4.4370
12	0.259033	0.695483	1.356217	1.782288	2.17881	2.68100	3.05454	4.3178
13	0.258591	0.693829	1.350171	1.770933	2.16037	2.65031	3.01228	4.2208
14	0.258213	0.692417	1.345030	1.761310	2.14479	2.62449	2.97684	4.1405
15	0.257885	0.691197	1.340606	1.753050	2.13145	2.60248	2.94671	4.0728
16	0.257599	0.690132	1.336757	1.745884	2.11991	2.58349	2.92078	4.0150
17	0.257347	0.689195	1.333379	1.739607	2.10982	2.56693	2.89823	3.9651
18	0.257123	0.688364	1.330391	1.734064	2.10092	2.55238	2.87844	3.9216
19	0.256923	0.687621	1.327728	1.729133	2.09302	2.53948	2.86093	3.8834
20	0.256743	0.686954	1.325341	1.724718	2.08596	2.52798	2.84534	3.8495
21	0.256580	0.686352	1.323188	1.720743	2.07961	2.51765	2.83136	3.8193
22	0.256432	0.685805	1.321237	1.717144	2.07387	2.50832	2.81876	3.7921
23	0.256297	0.685306	1.319460	1.713872	2.06866	2.49987	2.80734	3.7676
24	0.256173	0.684850	1.317836	1.710882	2.06390	2.49216	2.79694	3.7454
25	0.256060	0.684430	1.316345	1.708141	2.05954	2.48511	2.78744	3.7251
26	0.255955	0.684043	1.314972	1.705618	2.05553	2.47863	2.77871	3.7066
27	0.255858	0.683685	1.313703	1.703288	2.05183	2.47266	2.77068	3.6896
28	0.255768	0.683353	1.312527	1.701131	2.04841	2.46714	2.76326	3.6739
29	0.255684	0.683044	1.311434	1.699127	2.04523	2.46202	2.75639	3.6594
30	0.255605	0.682756	1.310415	1.697261	2.04227	2.45726	2.75000	3.6460