DEPARTMENT OF CIVIL ENGINEERING: IIT DELHI

CVL 773: QUANTITATIVE METHODS IN CONSTRUCTION. MINOR TEST-I

DURATION: 1.0 Hour. FIRST SEMESTER-2022-2023 Max. marks:=25

DATE:- 26/09/2022 TIME:- 9.30 A.M. – 10.30 A M Venue: LH 526

ASSUME MISSING DATA SUITABLY IF REQUIRED

1. A construction company has secured two projects; a bridge project and a housing projects. The common equipment required during the early stage of both these projects are a) wheel/crawler mounted cranes, b) JCB (0.75m^3 bucket capacity) and c) Tipper trucks of 20 m^3 capacity. The company wishes to hire these equipment optimally with minimum hiring cost per month. The relative cost of hiring/month for cranes, JCB and tipper trucks are 8, 5 and 3 respectively. For timely completion of projects, every JCB in projects requires at least 3 trucks for transportation of excavated soil, with a minimum buffer number of 2, to avoid stoppage of work due to breakdown. The company has already obtained a mobilization amount for minimum of 25 such equipment in total for both the projects. The contractual requirement for construction of bridge project require that company must initiate foundation work with crane in at least 3 locations, each location requiring at least one crane. Minimum one cranes is also required for setting up casting yard for housing projects. Formulate the linear optimization problem and obtain the initial starting table using Big M method and the table after 1 iteration. Formulate also the dual problem. 13

2. For casting of a precast box element following data on cement consumption was recorded for 6 consecutive times, at some point of time at the initial phase of project. These are 12, 12.5, 11.5, 13, 14 and 12 t (tonne) respectively. Ordering for cement from the store on the basis of guess works resulted in either opening the store at odd hours and stoppage of casting due to inconvenience, and; some time too many bags of cement had to be returned back to store often in unusable condition. The engineer in charge decided that he would not falter more than 97.5% of the time in future, risking only 2.5% of time. How many (50 kg) bags of cement he should put as the requirement for future casting of the same element. 7

3 Cost of quality increases as sampling frequency and testing increases, the rate of increase of cost is constant to a value "b" with the measure of quality Q is 0 for no quality control. The cost of failure to maintain quality is inversely proportional to measure of quality Q such that at no quality control cost is "c" and when quality tends to be very high i.e. infinity, the cost asymptotically tends to zero. Obtain the level of quality Q in terms of b and c for minimum total cost?

"t" distribution table

	P						
one-tail	0.1	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	0.2	0.1	0.05	0.02	0.01	0.002	0.001
DF							
1	3.078	6.314	12.706	31.821	63.656	318.289	636.578
2	1.886	2.92	4.303	6.965	9.925	22.328	31.6
3	1.638	2.353	3.182	4.541	5.841	10.214	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.61
5	1.476	2.015	2.571	3.365	4.032	5.894	6.869
6	1.44	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.86	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.25	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.93	4.318
13	1.35	1.771	2.16	2.65	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.14
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.12	2.583	2.921	3.686	4.015
17	1.333	1.74	2.11	2.567	2.898	3.646	3.965
18	1.33	1.734	2.101	2.552	2.878	3.61	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.85
21	1.323	1.721	2.08	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.5	2.807	3.485	3.768
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.06	2.485	2.787	3.45	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.689
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.66
30	1.31	1.697	2.042	2.457	2.75	3.385	3.646
60	1.296	1.671	2	2.39	2.66	3.232	3.46
120	1.289	1.658	1.98	2.358	2.617	3.16	3.373
1000	1.282	1.646	1.962	2.33	2.581	3.098	3.3
Inf	1.282	1.645	1.96	2.326	2.576	3.091	3.291