CEL 362 CONSTRUCTION MANAGEMENT

Time allowed: 2 hour	MAJOR	Maximum Marks 40
LH-316	Time 10:30 AM to 12:30 PM	10.05.2013

Answer all questions. Assume any suitable data in case it is missing.

Q 1. (4 marks)

For the following linear programming problem, construct its DUAL.

Minimize $Z=4X_1+5X_2$

Subject to

$3X_1 + 1X_2 \leq 27$

$5X_1 + 5X_2 = 6$

$6X_1 + 4X_2 \geq 6$

$X_1 \geq 0, X_2 \geq 0$

Q 2. (6 marks)

Maximize $Z = 9x_1 + 7x_2$

Subject to

$2x_1 + x_2 \leq 40$

$x_1 + 3x_2 \leq 30$

$x_1, x_2 \geq 0$

Solve the problem given above using simplex method.

Also answer the following questions:

a. Perform RHS ranging for constraint 1

b. If the right hand side of the constraint 1 were increased by 10, what would be the maximum possible profit?

c. Find the range of optimality for the profit on x1.

Q 3. (4 marks)

A contractor has been successful in obtaining five new projects. The projects, however, are different in value, type of work and complexity. As a result the experience and qualities required of the project manager for each will be different. After careful consideration, five managers are selected and their skills assessed against each project. Each manager is scored on a points scale, with a maximum of 100 marks indicating that the manager is highly suitable, and zero mark unsuitable for the work. The individual assessments are shown in the following table. Which managers should be allocated to which projects, if the company wishes to distribute them in the most effective way?

		Manager				
		(1)	(2)	(3)	(4)	(5)
Projects	A	75	28	61	48	59
	B	78	71	51	35	19
	C	73	61	40	49	68
	D	55	50	52	48	63
	E	71	60	61	74	70

Q 4. (6 marks) Use least cost method

A civil engineering contractor is engaged to carry out the earth-moving work for the construction of a new section of roadway. Fill material can be supplied from three borrow pits 1,2, and 3 located near the works, up to a maximum of 60000, 80000 and 120000 cum from each, respectively. The material is to be delivered to three locations, A B and C along the road, and each requires 90000, 50000, and 40000 cum respectively. The cost in Rs. per cum for delivery of the material from the pits to each of the three sites are shown below in the table. Determine the best arrangements, for supply and delivery of the material, if the objective is to minimize cost.

		Pits			
		(A)	(B)	(C)	Quantity supplied from pits
Pits	1	70	40	100	$60000m^3$
	2	50	30	90	$80000m^3$
	3	60	50	90	$120000m^3$
Quantity required at sites		$90000m^3$	$50000m^3$	$40000m^3$	

Q. 5 (5 marks)

The records of 10 previous bids in which you and your competitor have participated are given in the following table. The bidding behavior of a typical competitor against you, as a contractor, has revealed that *his bid/your* cost in take the following histogram.

Sl No.	B/C Ratio (Competitor's bid price ÷ your cost)	No of bids
01	1.04	2
02	1.08	4
03	1.12	1
04	1.16	2
05	1.2	1

$V = \left(\frac{b-a}{6}\right)^2$

$\sigma = \sqrt{V}$

(a) Based on the above behavior, what is the markup value that this competitor uses on average? What is the probability of winning this competitor if you use a markup of 14%?

(b) In a new project with a $1,000,000 estimated cost, what is your optimum markup strategy against four typical competitors using Friedman's model? What is the expected profit at optimal markup?

Q 6 (5 marks)

A new product is to be released on a deadline for which 25 days are left. Remaining activities in product launch with their interdependencies, expected average times and standard deviations are given in the table. Draw a project network using AoA convention and find the probability of completing the project in time.

ACTIVITY	PRECEEDING ACTIVITIES	AVERAGE Ta	Standard Deviation
A	-	6	1.5
B	-	3	0.5
C	A	5	1.0
D	A	4	0.5
E	A	3	0.5
F	C	3	0.5
G	D	5	1.0
H	B,E,D	5	2.0
I	H	2	0.5
J	I,G,F	3.5	1.5

Q 7 (5 marks)

The table below defines the activities within a small project.

ACTIVITY	DURATION (WEEKS)		COST ($)	
	NORMAL	CRASH	NORMAL	CRASH
1-2	6	3	40,000	70,000
1-3	5	3	30,000	52,000
2-4	3	2	60,000	84,000
3-4	10	6	70,000	98,000
2-5	3	2	45,000	63,000
4-5	4	2	26,000	50,000

The indirect costs are $11,500 per week.

a) What is the minimum time in which project can be completed considering maximum possible crashing?

b) What will be the total project cost if the schedule is crashed to the maximum?

Q 8 Write short notes on the following (1x5=5 marks)

a) Mark up

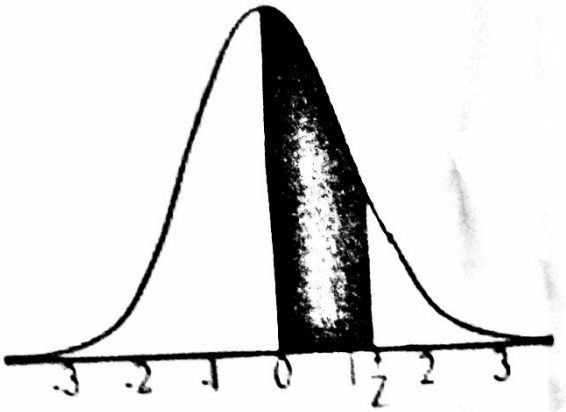
b) Liquidated damage

c) Defect liability period.

d) Item rate contract

e) Secured advance

STANDARD NORMAL DISTRIBUTION



The following table can be used to find the area under the curve from the central line to any Z-value up to 3.
To determine the area under the curve between 0 and 1.35, start at the row for 1.3, and read along until 1.35. The value corresponding to $Z = 1.35$ is 0.4115.

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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	0.0753
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	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	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	0.2995	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