BA3320 Fundamentals of Production

EXAM 1 Fall, 2006 Dr. Banis

Show calculations or you may not get credit

NAME:

Section time:

total 300

I ***Salting the Roads at Humongo Corp.***

Humongo Corp salts its private roads and parking lots. The employees who drive around in rusted out old Pontiacs wonder why the facilities people use so much salt despite the relatively mild climate. The Consulting Yahoo Agency (CYA) does management training at Humongo. A committee of middle -managers at Humongo is paid big bucks to help the Safety and Operations Council (SOC) make an informed decision to do one of three things:

1. Use no salt, or very little
2. To use moderate amounts and live with an occasional undersalting.
3. To dump phenomenal amounts of salt every time the weather gets cold, just in case (JIC)

The result of these policies depends on what actually happens with the weather and with the litigious proclivities of the populace who might slide on the ice. Dumping heebiegobs of halides also results in the need to replace shrubs and company vehicles frequently due to the corrosion. This gives the costs shown in the table.

20

Total **cost** of as a function of severity of storm and litigousness of the populace

	combined cost of salt and suits ($K)			
weather & attitudes	mild	icy	bitter	EMLoss
Probability	0.75	0.20	0.05	
little salt	10	20	2,000	
bunches of salt	100	100	1,000	
Heebiegobs of halides	1,000	1,000	1,000	

10

If costs are "too high", SOC members worry they could get fired for giving bad advice(SOC would be sacked). Show what they would recommend if they were taking a minimax regret strategy. Circle the lowest worst regret.

20

Potential Regrets as a function of severity of storm and litigousness of the populace

	Regrets		
weather & attitudes	mild	icy	bitter
little salt			
bunches of salt			
Heebiegobs of halides			

10

What does it cost the company because SOC uses CYA instead of Minimizing expected loss?

Total = 60

II 1) You are selling LP gas powered golf carts that have normally distributed lifetimes (before needing major service) with a mean of 10 years and standard deviation of 3 years. How long should you make the warranty so that there will be less than 20% chance of breakdown within the warranty period? (show work and put answer in the box)

warranty length

2) There are two ways to produce color covers for books we are printing and binding in house. **Ignore the time value of money**

1. Pay to have them printed outside. Fixed setup cost is $100 per year and each cover costs 50 cents.
2. Buy a new color printer and print in house at a cost of 25 cents each (including paper, toner, electricity, etc.). Purchase of the color printer, fixed maintenance etc, would run $2000 per year

How many copies would I have to make per year to break-even on buying the color printer?

Breakeven copies/year

3) Sales of ice cream and hot latte are weather dependent. Ice cream profit is only $10K in cold weather, but $40K in hot. Hot latte sells better in cold weather. Profit is $30K in cold weather, $10K in hot. At what probability of hot weather would you be indifferent between these two businesses?

1. Phot= 20%
2. Phot= 30%
3. Phot= 40%
4. Phot = 50%
5. Phot= 80%
6. Phot= 150%
7. 100% of each
8. Phot=50/ 80
9. Phot= 60/70
10. Phot= 10/45

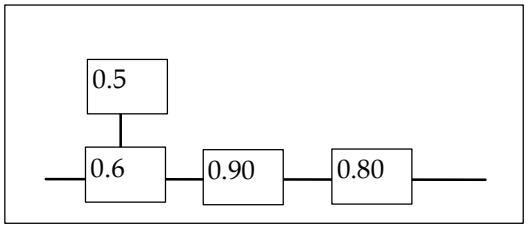
15 each

4) You are filling 32 oz. spaghetti sauce jars using a process with a standard deviation of 4 ounces. If you want your X-bar chart to have 3 sigma limits on either side of the mean and to have LCL, UCL at 29 and 35 oz. respectively, how large a sample should you use for each data point?

1. one
2. two
3. four
4. twelve
5. twenty-five
6. sixteen
7. one hundred

5) If the cost of a failure is $2000, what is the approximate value of the backup piece labeled r=0.5?

1. $288
2. $1152
3. $864
4. $2000
5. $1000
6. less than $100



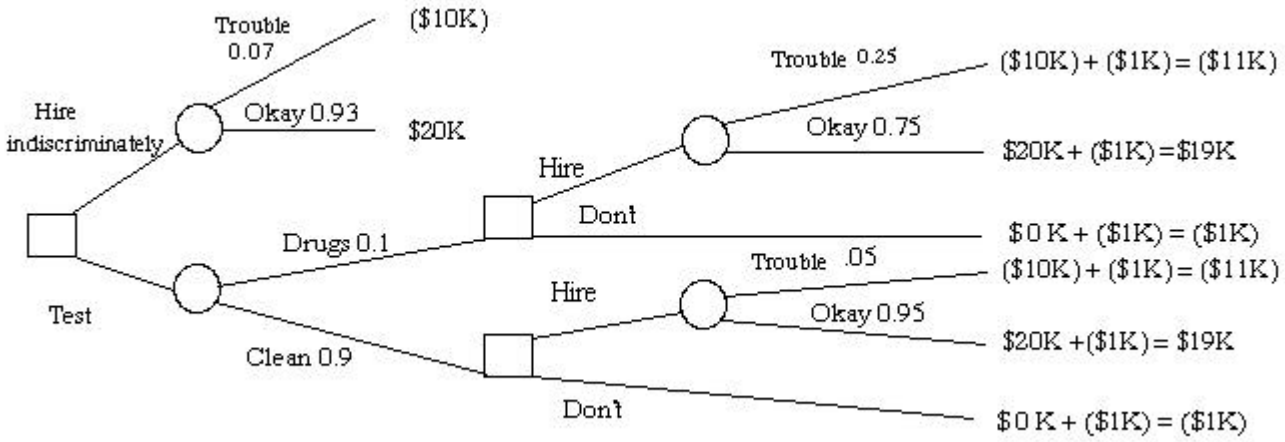
Total = 75

III

A decision tree on whether to test employment candidates for substance abuse:

(These are actual estimates from about 20 years ago)

Employees with drug abuse habits have a higher probability (25%) of causing trouble than employees who don't have habits (5% probability of causing trouble). You have a test for drug abuse that is 100% reliable, and it only costs $1000 per candidate. It would only be used on the preferred candidates for jobs that are available now and who had met all other criteria. Ten percent of job candidates who get this far have drug abuse habits.
Six percent of all candidates at this level would cause trouble as employees.
Employees who don't cause trouble result in $20K profits over the average tenure of employment.
Employees who cause trouble result in losses of $10K.
These data would result in the following tree showing profits. The numbers in parentheses are negative profits, or costs:



A) Calculate values at the intermediate nodes (branch points) and show decisions.

B) To maximize EMV, which alternative would you choose?

40

B) How much is the test worth? Explain this result.

C) Since the Drug test is 100% reliable in identifying drug users, is this test value the value of perfect information on troublemaking employees?

20

Total = 60

IV Humongo Company has hired a bright new MBA from the College of Higher University Graduates (CHUG). The student was indoctrinated with enthusiasm in the strategy of getting rich by using Other Peoples' Money (OPM). To do this, he implemented a "Cash Management Program" that involved "aging invoices" to put off paying suppliers and to take maximum advantage of their generous terms. A complicated system was implemented to invest the OPM in order to get the interest from the money while putting off the creditors.

Unfortunately, supplier Biggo Stores caught on to this strategy and raised their prices to compensate for the free loans and hired two new MBA cash managers to tighten up on their Accounts Receivable. The end result when everybody tries to get rich at everybody elses' expense is that everybody loses.

As an alternative, both companies could fire their MBA's, go back to paying invoices when they are received, or, even more expeditiously, could implement an automated Electronic Funds System that transfers cash when goods are received, with no float, making price adjustments to reflect everybodys' savings in transaction costs.

These options results in the following matrix of transaction costs adjusted for interest earned , with H's costs in the upper left corners and B's in the Lower right. H controls which row in each column. B controls which column in each row.

A) Is this a zero-sum game? Why or why not?

$K Transaction Costs for paying invoices early vs. The OPM strategy.

Humongo / / Biggo	Allow terms	price increases	raise price and Monitoring system
Electronic immediately	50 / / 50	250 / / 40	130 / / 30
some float	25 / / 500	240 / / 400	125 / / 50
deliberately delay	10 / / 1300	50 / / 1250	120 / / 120

5 B) What would the best combination of strategies be for Humongo and Biggo if they were cooperating to minimize total transaction costs (What cell has the lowest total?)

5

C) Assuming that H and B work independently to minimize their costs in a one-round Prisoner's dilemma approach, show what H's response would be to each strategy of B and vice-versa. Use squares for H and circles for B.

30

D) Draw lines through rows and columns that represent dominated strategies that wouldn't be pursued by each competitor regardless of the other's strategy.

10 E) What is the stable result for each following the prisoner's dilemma competitive strategy ?

5 F) What could be done to enforce an agreement between the two to pursue the best result rather than the prisoner's dilemma result?

5

Total = 60

Values are Rounded and may not add up

V

Linear Programming (cafe lite and cafe burnt)
Mills Brothers Coffee Company makes 4 blends of coffee: Premium (P), Commercial(C), Watery (W) and Robusto (R). They take different amounts of labor, beans, cereal, grinding machine time and roasting machine time per can as shown in the table. Profits per can are also shown on the table

Computer Printout--the model

	P	C	W	R		RHS= Available
Unit Profit-->	5	2	2.5	7		
constraint						
labor min.	2	1.5	2	5	<=	8,000
Beans lb.	2	1.5	0.5	2.5	<=	5,000
Cereal lb	0.5	0.5	1.5	0	<=	12,000
Grind min.	2	1.5	1.5	3	<=	6,000
Roast min.	2	2	1.5	5	<=	10,000

15 1) What is the optimal production plan and what would the profit be for that plan?

10 2) Suppose someone offered to buy your grinding time for $2/min. How many minutes are you sure you should sell?

10 3) how many pounds of beans are you sure you should sell if the price were $5/lb.?

10 4) If everything else remained the same, how low could the profit on commercial grind go before you would change to a different solution?

Computer Printout--Range of Optimality for Objective Function Coefficients

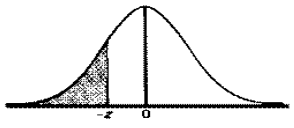
Variable	Value	Current Coefficient	Lower Limit	Upper Limit
Premium	1,286	5	3.4	5.11
Commercial	0	2	-infinity	3.75
Watery	571	2.5	1.7	2.75
Robusto	857	7	6.88	8.33

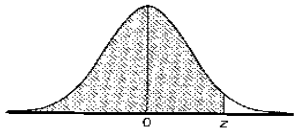
Objective Function Value =13857

Computer Printout--Range of Validity for Shadow Prices

Constraint	RHS	Slack	Shadow Price	Lower Limit	Upper Limit
labor min.	8,000	0	0.07	6,500	10,000
Beans lb.	5,000	0	1.29	2,000	5,500
Cereal lb	12,000	10,500	0	1,500	+infinity
Grind min.	6,000	0	1.14	5,600	7,000
Roast min.	10,000	2,286	0	7,714	+infinit

Total =45





0.0900	0.0800	0.0700	0.0600	0.0500	0.0400	0.0300	0.0200	0.0100	0.0000	Z
0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	-3.4
0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005	-3.3
0.0005	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007	-3.2
0.0007	0.0007	0.0008	0.0008	0.0008	0.0008	0.0009	0.0009	0.0009	0.0010	-3.1
0.0010	0.0010	0.0011	0.0011	0.0011	0.0012	0.0012	0.0013	0.0013	0.0013	-3.0
0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	0.0019	-2.9
0.0019	0.0020	0.0021	0.0021	0.0022	0.0023	0.0023	0.0024	0.0025	0.0026	-2.8
0.0026	0.0027	0.0028	0.0029	0.0030	0.0031	0.0032	0.0033	0.0034	0.0035	-2.7
0.0036	0.0037	0.0038	0.0039	0.0040	0.0041	0.0043	0.0044	0.0045	0.0047	-2.6
0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0060	0.0062	-2.5
0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082	-2.4
0.0084	0.0087	0.0089	0.0091	0.0094	0.0096	0.0099	0.0102	0.0104	0.0107	-2.3
0.0110	0.0113	0.0116	0.0119	0.0122	0.0125	0.0129	0.0132	0.0136	0.0139	-2.2
0.0143	0.0146	0.0150	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0179	-2.1
0.0183	0.0188	0.0192	0.0197	0.0202	0.0207	0.0212	0.0217	0.0222	0.0228	-2.0
0.0233	0.0239	0.0244	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287	-1.9
0.0294	0.0301	0.0307	0.0314	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359	-1.8
0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446	-1.7
0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548	-1.6
0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668	-1.5
0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808	-1.4
0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968	-1.3
0.0985	0.1003	0.1020	0.1038	0.1056	0.1075	0.1093	0.1112	0.1131	0.1151	-1.2
0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357	-1.1
0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587	-1.0
0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841	-0.9
0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119	-0.8
0.2148	0.2177	0.2206	0.2236	0.2266	0.2296	0.2327	0.2358	0.2389	0.2420	-0.7
0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743	-0.6
0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085	-0.5
0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446	-0.4
0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821	-0.3
0.3859	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207	-0.2
0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602	-0.1
0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4880	0.4920	0.4960	0.5000	0.0

Z	0.0000	0.0100	0.0200	0.0300	0.0400	0.0500	0.0600	0.0700	0.0800	0.0900
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7703	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

Z=(X-Mu) / S.E.
the appropriate SE depends on whether you have an individual X or a mean of several values, then SE= S/sqrt(n)
Use Z when the mean and SD of the population are known
Use t when the population parameters are estimated from the sample
As n becomes larger, the correction to (n-1) is less significant, and so with a large sample, it's permissible to use Z instead of t.

In EXCEL

The cumulative P values in this table can also be obtained by NORMSDIST (Z)
For t distributions (sample statistics) TDIST (t, df, tails) will give the pvalues

A reverse look-up where P gives the Z value is NORMSINV (P)
corresponding values for t distributions can be obtained from TINV (P, df)