École de gestion TELFER School of Management

LIÉE au LINKED with LEADERSHIP

Final Exam

ADM 2302: Business Decision Models

Sections A, B, C, and D

Monday, December 19, 2011

Last Name: _____ **First Name:** _____

Student #: _____

Section (Circle):

A	(Professor W. Michalowski)
B & C	(Professor S. Phansalker)
D	(Professor D. Lane)

This exam booklet contains 11 pages -if yours does not, please inform the professor immediately. Please answer all questions in the exam booklet. Only answers in this exam booklet will be marked. Show all work. The table of areas under the standardized Normal curve is provided on page 11 of the exam.

1. One page of notes (8 ½ by 11 inches), both sides, is allowed. Rulers are allowed. Please note that the notes page must be handed over with the exam copy at the end of the exam period.
2. Calculators are permitted for arithmetic use only.
3. NO COMMUNICATION DEVICES MAY BE WITHIN SIGHT.

Question	Value	Score
1	10	
2	10	
3	15	
4	15	
5	25	
6	25	
TOTAL	100	

Statement of Academic Integrity

The School of Management does not condone academic fraud, an act by a student that may result in a false academic evaluation of that student or of another student. Without limiting the generality of this definition, academic fraud occurs when a student commits any of the following offences: plagiarism or cheating of any kind, use of books, notes, mathematical tables, dictionaries or other study aid unless an explicit written note to the contrary appears on the exam, to have in his/her possession cameras, radios (radios with head sets), tape recorders, pagers, cell phones, or any other communication device which has not been previously authorized in writing.

Statement to be signed by the student:

I have read the text on academic integrity and I pledge not to have committed or attempted to commit academic fraud in this examination.

Signed:_____

Note: an examination copy or booklet without that signed statement will not be graded and will receive a final exam grade of zero.

QUESTION 1 (10 points) **Linear Programming Formulation**

The GreenSink Company's production manager is planning a series of monthly production for its stainless steel sinks. The forecasted demand for the next three months is as follows:

Month	Demand for Stainless Steel Sinks
1	220
2	340
3	260

The GreenSink firm can normally produce 200 stainless steel sinks in a month. This is done during regular production hours at a cost of $100 per sink. If demand in any month cannot be satisfied by regular production, the production manager has two other choices:

(1) Each month a limited number of sinks can be purchased from a friendly competitor for resale (the maximum number of outside purchases over the three-month period is 250 sinks, at a cost of $150 each);

(2) Or, demand can be filled from on-hand inventory. The inventory carrying cost is $20 per sink per month.

Production from a given month can be used to satisfy demand in the following months (i.e., production in Month 1 can be used to meet demand in Month 2 and Month 3). Back orders are NOT permitted (i.e., production in Month 2 cannot be used to meet demand from Month 1). Inventory on hand at the beginning of Month 1 is 25 stainless steel sinks.

Formulate algebraically the above "production" problem to minimize cost. **DO NOT SOLVE.**

Solution

Decision Variables: (3 points)

x_i = quantity produced in month *i* on a regular time basis.

s_i = quantity subcontracted for month *i*.

I_i = quantity in inventory at the end of month *i*.

where i= 1, 2, 3

Minimize $Z = \$100(x_1 + x_2 + x_3) + 150(s_1 + s_2 + s_3) + 10(I_1 + I_2 + I_3)$ (2 points)

Subject to:

$x_1 <= 200$; $x_2 <= 200$; $x_3 <= 200$ (1 point)

$s1 + s2 + s3 <= 250$

$25 + x_1 + s_1 - I_1 = 220$ **(3 points)**

$I_1 + x_2 + s_2 - I_2 = 340$

$I_2 + x_2 + s_2 - I_3 = 260$

all decision variables>= 0 **(1 point)**

Diagnosis: "Easy" points expected 5 of 10 (for defining decision variables, objective function); "Medium points: +2 for Balance Equation constraints; "Hard" points: +3 for all)

QUESTION 2: (10 points) **Linear Programming Solution & Sensitivity**

Everland Amusements, Inc. is trying to divide its new 50 acre park into three categories of the activities: (1) rides, (2) food concessions, and (3) shops. Each acre used for rides generates $150/hour profit, each acre used for food generates $200/hour profit and shops generate $300/hour profit. There are a number of restrictions on how the park can be divided. These include:

- Only 10 acres of land is suitable for shops.
- Zoning regulations require at least 1000 trees in the park.
- An acre devoted to food concessions has 30 trees, a ride acre has 20 trees, while a shop acre has no trees.
- No more than 200 people can work in the park. It takes 3 people to work an acre of rides, 6 to work an acre of food concessions, and 5 to work an acre of shops.

A correct LP model that Maximizes contribution to profit per hour, and the associated Excel Solver output are given below.

Let Ride, Wood, Shop denote the numbers of acres committed to rides, food concessions, and shops in Everland.

Max z = 150 Ride + 200 Food + 300 Shop

subject to,

Ride + Food + Shop	<= 50
Shop	<= 10
20 Ride + 30 Food	>= 1000
3 Ride + 6 Food + 5 Shop	<= 200
Ride, Food, Shop >= 0	

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
B2	Solution Ride	31.25	0	150	83.33333333	76.66666667
C2	Solution Food	12.5	0	200	115	125
D2	Solution Shop	6.25	0	300	1E+30	116.6666667

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
E6	Land LHS	50	143.75	50	10	16.66666667
E7	ShopLimit LHS	6.25	0	10	1E+30	3.75
E8	Trees LHS	1000	-4.375	1000	166.6666667	100
E9	Workers LHS	200	31.25	200	30	50

The following questions represent changes to the original problem above. Your task is to respond to these changes by indicating the impact below using the formulation and Excel Solver solution and sensitivity analysis.

a) Suppose the unit profit on Food was $180/hour. What would be the new optimal allocation of Everland acres, and what would be the total profit/hour of the park? (3 points)

b) A construction firm is willing to convert 5 acres of land to make it suitable for shops. How much should Everland be willing to pay for this conversion (in $/hour)? (3 points)

c) An adjacent parcel of land has become available. It is 8 acres in size. The owner wants to share the profits. How much (in $/hour) should Everland be willing to pay? (4 points)

Answers to Question 2

a)

New value is within a range, so optimal values of the decision variables remain the same as original.

New total profit: 9062.5 + (-20)x12.5/h

b)

Should pay nothing (shadow price = 0) because the ShopLimit constraint is not binding.

c)

Shadow price of land constraint = 143.75. Proposed increase is within the range, so should pay 143.75x8

Diagnosis: “Easy” points expected = 5 (for part (a) and part so b and c); “Medium” points: +2 (for parts a and b part of c); “Hard” points: +3 (for all parts).

QUESTION 3: (15 points) **Integer/Binary Programming**

At its final meeting of the fiscal year, the City Council will be making plans to allocate funds remaining in this year's budget. Nine projects have been under consideration throughout the entire year.

The estimated cost of each project and the estimated number of permanent new jobs each would create is summarized in the table below. X1, X2,…,X6 are binary decision variables, and Xi = 1 if project "i" is funded, and 0 if project "i" is not funded.

Decision

Variables	**Project**	**Cost (in $1,000s)**	**New jobs**
X1	Hire seven new police officers	400	7
X2	Modernize police headquarters	350	0
X3	Buy new fire truck	500	2
X4	Fund sports program	220	8
X5	Fund school music program	150	3
X6	Buy new computers for high school	140	2

Write down the corresponding constraints for this problem:

(a) The budget remaining in this year is $1,600,000. (3 points)

400X1 + 350X2 + 500X3+ 220X4 + 150X5 + 140X6 <= 1,600

(b) The council wants to create at least 10 new jobs. (3 points)

7X1 + 2X3 + 8X4 + 3X5 + 2X6 >= 10

(c) The council would like to increase the status of the police department by either modernizing the police headquarters building, or hiring the seven new officers. However, in the face of other pressing issues, exactly one of the two police projects could be funded at this time. (3 points)

X1 + X2 = 1

(d) In order to avoid bickering between parents who are sports oriented and those who are music oriented, the council has decided that if the sports program is funded then the school music program must be funded and vice versa. (3 points)

x4 = x5

(e) Both sports program and music program must be funded before new computer equipment can be purchased. Funding sports and music program, however, does not imply that new computers *will* be purchased, only that they *can* be purchased. (3 points)

X6 <= X4

X6 <= X5

Diagnosis: "Easy" points expected =9 of 15 (for all or part of the parts a, b, c, d); "Medium" points: +3 (for al or part of c, d, e); "Hard" points: +3 (for all parts).

QUESTION 4: (15 points) **Goal Pogramming**

Babylon Telephone Equipment Ltd. (BTE) produces a number of products ranging from consumer products to networking equipment. BTE's main consumer products are three models of cordless telephone: the Yeoman, the Debutante, and the Sportif. There are set-up costs for the Yeoman and Debutante models, namely $2000 and $3000, but no set-up cost for the Sportif. Profit contribution per phone sold is $28 for the Yeoman, $35 for the Debutante and $30 for the Sportif.

The demands for the models are: 300 Yeomans, 450 Debutantes and 500 Sportifs. BTE absolutely will not produce more than the demand for any product and they must produce full items (fractional or non-integer production is not permitted). In addition, material limitations mean that BTE can produce at most 1100 telephones in total.

The numbers of hours needed to produce each product and the capacity limitation related to labour hours on the production line is provided in the table below:

Hours/Unit			**Labour hours capacity**	
Yeomans	**Debutantes**	**Sportifs**	**Minimum**	**Maximum**
6	3	2	4500	4800

BTE sets specific goals for this production problem, as follows:

1. Total net profit should be at least $15000 (Goal multiplier of 1);
2. Under Union regulations, no more than the Maximum Labour Capacity hours should be assigned;
3. Under the same Union regulations, no less than the Minimum Labour Capacity hours should be assigned (multiplier for Goals 2 and 3 is 4).

The objective is to meet the above goals. FORMULATE algebraically the above problem. **DO NOT SOLVE.**

Suggested Solution:

Decision variables: half point for each type (total: 3 points)
Let Xi denote number of phones "i" where i = y (Yeoman), d (Debutantes), s (Sportif)
Let Yj = 1 if phone "j" is made, where j = y or d; 0 otherwise

Let Di+(up) and Di-(down) be the amount of overachievement (underachievement) of goal i, where i = 1, 2, 3

Objective function: Minimize 1*D1-(down) + 4[D2+(up) + D3-(down)] (3 points)

Subject to

Demand constraints (1 for each - 3 points total)
Xy <= 300Yy
Xd <= 450Yd
Xy + Xd + Xs <= 1100

Goals

1) 28Xy + 35Xd + 30Xs – 2000Yy – 3000Yd = 15000 + D1+(up) – D1-(down) (1 point)
2) 6Xs + 3Xs + 2Xd = 4800 + D2+(up) – D2-(down) (1 point)
3) 6Xs + 3Xs + 2Xd = 4500 + D3+(up) – D3-(down) (1 point)

Xi >= 0 and integer (3 points)

Di+(up), Di-(down) ≥ 0 for i = 1,2,3

Yy, Yd binary (0,1)

Diagnosis: "Easy" points expected =7 of 15 (for decision variables, some constraints, objective function) "Medium" points: +4 (for defining variables, constraints, etc,); "Hard" points: +4 (for all).

QUESTION 5 (25 points) **Decision Analysis**

On Thursday, Mr. Cormier (58 years old, family history of heart problems) decided to see his doctor about chest pains. He learned that his "bad" cholesterol was high. Dr. Walla presented him with a choice: (1) severe and immediate saturated and trans-fat reduction diet, or (2) gradual reduction in saturated and trans-fat intake from a slow-change diet with anti-cholesterol pill supplements. The doctor believed that if Mr. Cormier strictly followed either of these options, then he could indeed end up with no cholesterol problem. Alternatively, his cholesterol problems might well continue under any strategy.

Mr. Cormier also considered the "Do Nothing" option and the "No Cholesterol Problem" state as most desirable, and he assigned it a score (consequence) of +10. Since it would be difficult to go on the severe diet, he assessed the score of "Severe Diet" and the "No Cholesterol Problem" state as only +7, and finally, since he did not like taking pills, he assessed the score of "Gradual Diet + Pills" and the "No Cholesterol Problem" state as only +8.

He also gave a score of -9 to the case of "Continuing Cholesterol Problems" under the "Severe Diet" option, while assigning a score of -15 for the "Continuing Cholesterol Problems" after the Gradual Diet option that included taking pills. Finally, he assigned a score of -12 to the "Do Nothing" and the "Continuing Cholesterol Problems" outcome.

Note: It is assumed that the only possible outcomes are: (1) "No Cholesterol Problem", or (2) "Continuing Cholesterol Problems".

a) Help Mr. Cormier make a decision on which of Dr. Walla's options to carry out by writing out the payoff table and analyzing the problem in the space below. **Justify your selection of the appropriate decision criterion that was used to identify the best option for Mr. Cormier.** (6 points)

Solution: This problem requires setting up the 3x2 decision table and analyzing it using criteria unde uncertainty (no probabilities):

		State				
		No cholesterol Problem	Continuing Cholesterol	Pessimistic I: **Maximin**	Pessimistic II: **Minimax Regret**	
Decisions	Severe Diet	7	-9	-9	3	<-- Best strategy
	Gradual Diet+Pills	8	-15	-15	6	
	Do Nothing	10	-12	-12	3	<-- Best strategy

Criterion selected: "PessimisticI" - Maximin; Best strategy: "Severe diet"; Score = -9
OR, alternatively (only 1 criterion should be selected):
Criterion selected: "PessimisticII"-Minimax Regret; Best strategy: "Severe diet" OR "Do Nothing"; Score=3

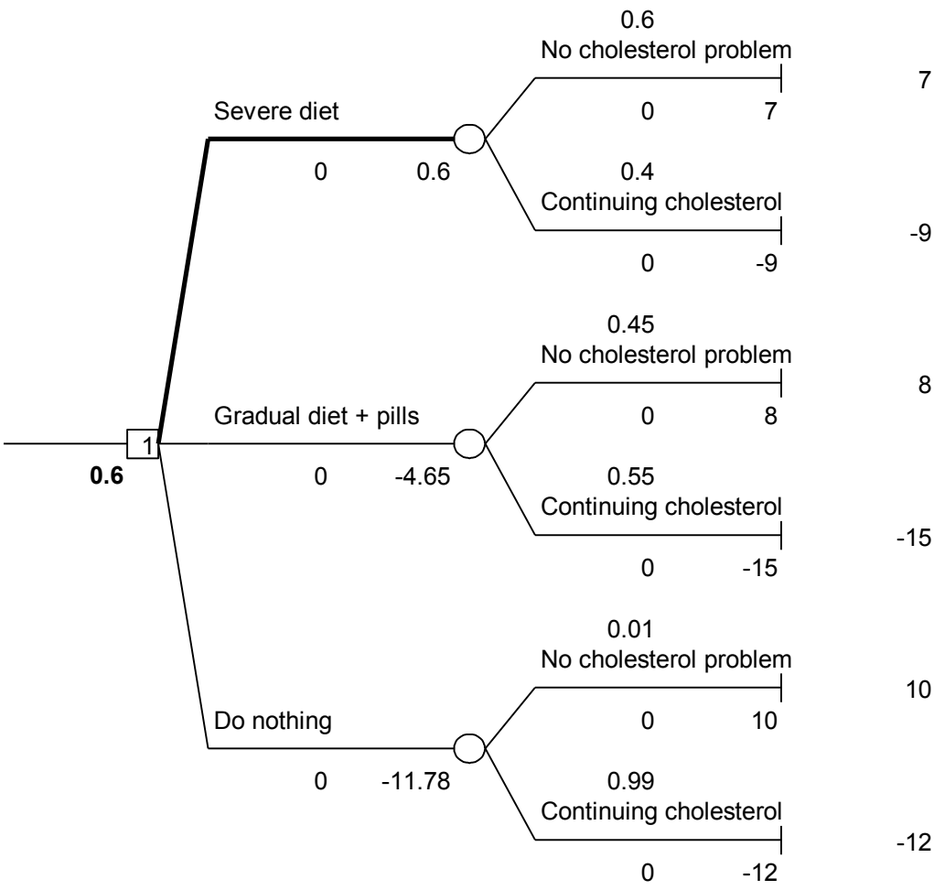
Diagnosis: "Easy" points expected =3 of 6 (for recognizing decision making under uncertainty and for writin down the decision table); "Medium" points: +2 for rationale of either choosing a "pessimistic" criterion or "optimistic" criterion; +1 for analysis and statement of "best strategy")

QUESTION 5 (continued)

At home, Mr. Cormier's son, Claude, did a thorough Google search on his father's condition and found some new information about the options. He summarized the information in the form of probabilities of having "No Cholesterol Problem" for each of the strategy options his father followed as below:

1. 60% after the severe diet;
2. 45% after the gradual diet with pills;
3. 1% after doing nothing.

b) Using the information from his son, draw the decision tree for this problem and determine Mr. Cormier's best option using decision tree analysis. (6 points)



Best strategy: Severe Diet; EV of tree = Score of 0.6

Diagnosis: "Easy" points expected =3 of 6 (for drawing the decision tree and applying the probabilities a given); "Medium" points: +2 for analysis and statement of "best strategy";

Part marks if a decision table is used, or carry over from part (a) is incorrect; -1 if forget to add "Do nothing option.

QUESTION 5 (continued)

When Mr. Cormier returned to Dr. Walla to inform him of his decision, the doctor mentioned to him about the new surgical technique that could relieve some of his immediate distress. The doctor told him that the surgery was "risky", i.e., there was only a 50% chance that the surgery would detect that his cholesterol problem was indeed fully curable and would disappear with time. In that case (i.e., given the surgery suggested "Curable Cholesterol"), there would be a 90% chance that all original options ("Severe Diet", or "Gradual Diet + Pills", or "Do Nothing") would result in "No Cholesterol Problem".

Given the surgery suggested "Dangerous Cholesterol" (50% chance), there would only be a 20% chance that the "Severe Diet" would result in "No Cholesterol Problem". Similarly, there would only be a 20% chance that the "Gradual Diet + Pills" would result in "No Cholesterol Problem". There would be 0% chance that the "Do Nothing" option would result in "No Cholesterol Problem".

c) Draw the decision tree for the surgery option in the space below. Determine the decision strategy and expected payoff value of the problem for Mr. Cormier using the above information. (10 points)

Solution:

(See "Surgery" branch of decision problem on the next page)

Best decision tree strategy:

Surgery - if Surgery says "Curable" then "Do Nothing", and if Surgery says "Dangerous" then adopt "Sever Diet".

EV(Surgery) = 1.0.

Diagnosis: "Easy" points expected = 5 of 10 (for drawing the tree branch for "Surgery" option);
"Medium" points: +3 for including the correct probabilities;
+3 for including the correct payoff, analysis and determination of EP of Surgery;

"Hard" points: +2 for correct managerial statement of interpretation.

e) **What is the additional value of the surgery option (EVSI)? (3 points)**

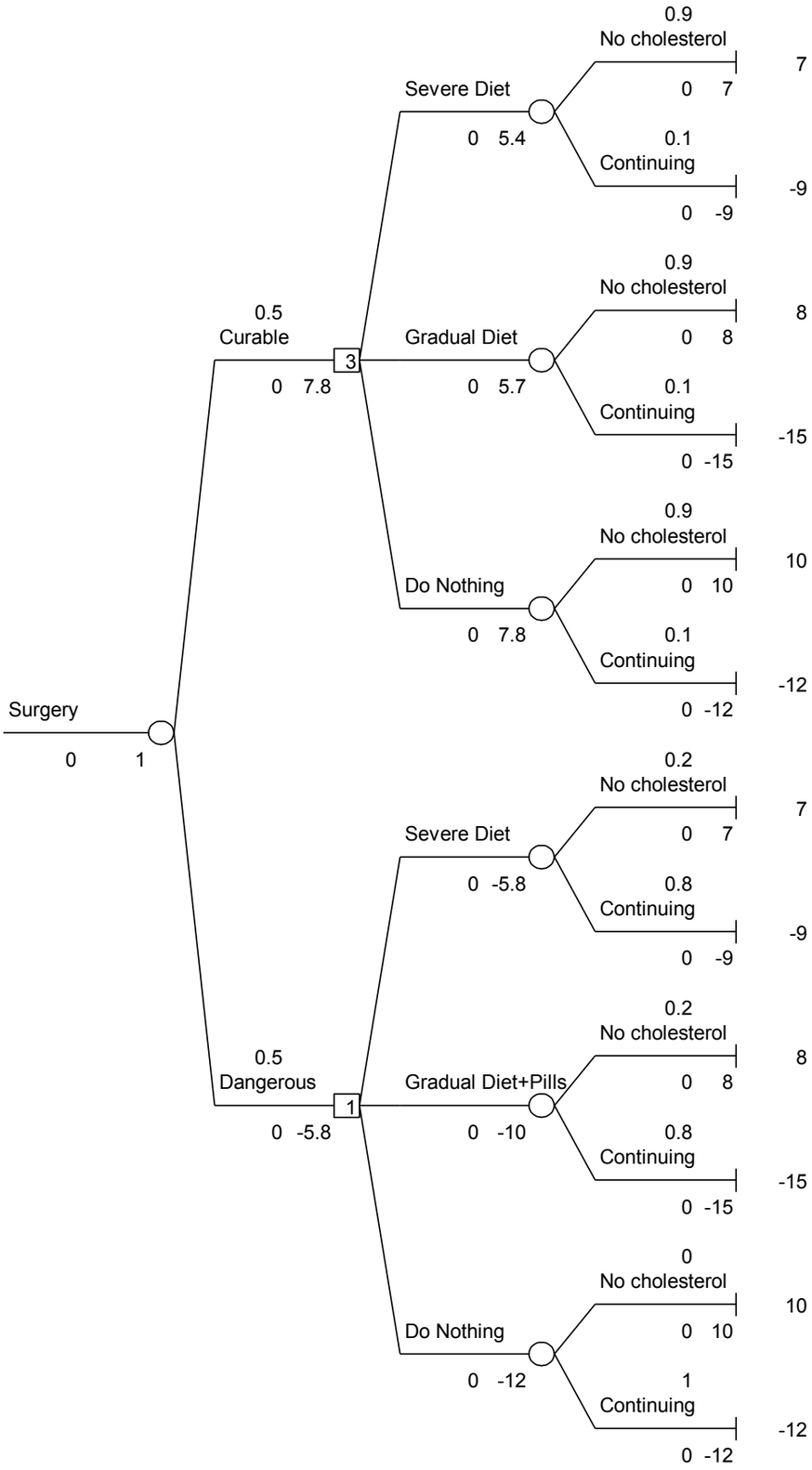
Solution:

(See "Surgery branch of decision problem below and original tree from part (b) above.)

EVSI = EV(Decision tree including the Surgery) - EV(Decision tree with No Additional Information)

EVSI = 1.0 - 0.6 = 0.4

Diagnosis: "Easy" points expected = 1 of 2 (for stating the formula for EVSI); "Medium" points: +2 for correct values.


Surgery
0
1
0.5
Curable
0 7.8
3
Severe Diet
0 5.4
0.9
No cholesterol
0 7
7
0.1
Continuing
0 -9
-9
Gradual Diet
0 5.7
0.9
No cholesterol
0 8
8
0.1
Continuing
0 -15
-15
Do Nothing
0 7.8
0.9
No cholesterol
0 10
10
0.1
Continuing
0 -12
-12
0.5
Dangerous
0 -5.8
1
Severe Diet
0 -5.8
0.2
No cholesterol
0 7
7
0.8
Continuing
0 -9
-9
Gradual Diet+Pills
0 -10
0.2
No cholesterol
0 8
8
0.8
Continuing
0 -15
-15
Do Nothing
0 -12
0
No cholesterol
0 10
10
1
Continuing
0 -12
-12

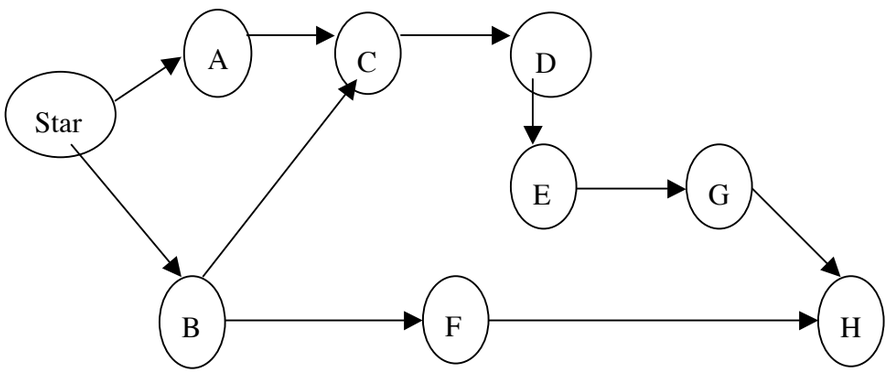
QUESTION 6 (25 points) **Project Management**

Before a new product can be introduced, the activities in the following table must be completed (all times are in weeks). The expected durations and variances have already been computed based upon Optimistic (a), Most Likely (m) and Pessimistic (b) times.

Activity	Description	Predecessors	Expected Duration	Variance
A	Design the product	___	6	64/36
B	Survey the market	___	5	4/36
C	Place orders for raw materials	A	3	4/36
D	Receive raw materials	C	2	4/36
E	Build prototype of product	A, D	3	16/36
F	Develop ad campaign	B	2	4/36
G	Setup plant for mass production	E	4	16/36
H	Deliver product to stores	G, F	2	16/36

a) Draw the project network. (4 points).

Most students will get this totally correct. If they include an arc from A to D, this is not wrong, just inefficient. Beyond that, I would say that if the student makes what appears to be a "mental lapse" error, **a mark of 2 out of 4 would be fine**. If the student just can't do much of a job on this very simple question, I'd go with a zero.



b) Complete the CPM table below (i.e., determine the Earliest Start and Earliest Finish times, the Latest Start and Latest Finish times (ES, EF, LS, and LF), and Slack for each of the activities). (5 points)

MARKING KEY: 1 mark for each column (i.e. ES, EF, LS, LF and slack)….per column deduct 0.5 mark for each mistake.

Activity	ES	EF	LS	LF	Slack
A	0	6	0	6	0
B	0	5	1	6	1
C	6	9	6	9	0
D	9	11	9	11	0
E	11	14	11	14	0
F	5	7	16	18	11
G	14	18	14	18	0
H	18	20	18	20	0

QUESTION 6 (continued)

c) Determine the critical path length and all critical activities. (2 points).

MARKING KEY: 1 for each part, no partial credit.

Critical path length: 20 weeks_____

Critical activities: A, C, D, E, G, H_____

d) Determine the Expected Project Completion Time and its Standard Deviation. (3 points).

MARKING KEY: 1 mark for mean, 2 marks for standard deviation

The expected project completion time is 20 weeks.

The project standard deviation is: $\sigma = \sqrt{\frac{64+4+4+16+16+16}{36}} = \sqrt{\frac{120}{36}} = 1.8257$

(accept 1.82 and 1.83 as a correct answer)

e) It is now 18 weeks before Christmas. What is the probability that the product will be in stores before Christmas? (5 points).

MARKING KEY: 1.5 marks for correct computation of z; 1.5 marks for getting correct probability from computed z

z = (18-20)/1.83 = -3/1.83 = -1.09

From the table:

P(x<= 18) = 1- 0.8621 = 0.1479

There is an approximate chance of 14.79% that the project will complete anytime before Christmas.

Diagnosis: "Easy" points expected =2 of 4 (for recognizing decision making under uncertainty and for writin down the decision table); "Medium" points: +1 for rationale of either choosing a "pessimistic" criterion or "optimistic" criterion; +1 for analysis and statement of "best strategy")

QUESTION 6 (continued)

f) The duration of each activity can be reduced by up to 2 weeks at the following cost per week: A-$80; B-$60; C-$30; D-$60; E-$40; F-$30; G-$20, H-$50. Assuming that the duration of each activity is known with certainty and it is now 18 weeks before Christmas. Crash this project so that the company can enjoy 2 weeks of shelf time before Christmas. (6 points).

MARKING KEY: 2 for variable definitions; 1 for objective function; 1 for $Y_i \leq 2$ constraints in aggregate.

Crashing solution by single period reduction of critical path elements.

Since the expected project length is 20 weeks, and it is now 18 weeks before Christmas and they want 2 weeks of pre-Christmas shelf time, then they need 4 weeks of crashing.

Students should:

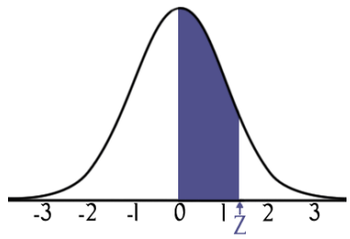
1) Identify all 3 paths and their expected lengths:
   - ACDEGH
   - BCDEGH
   - BFH

2) Reduce the critical path (ACDEGH) one step at a time for 4 weeks.

[Remainder of the solution to follow.]

S

Standard Normal Distribution Table (as per the ADM2302 Custom Text)



	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

Source: http://www.mathsisfun.com/data/standard-normal-distribution-table.html