

— If submitting a “hard (paper) copy”, staple this signed sheet as a cover —

Strayer University — Manassas Campus
Quantitative Methods — MAT540
— Fall 2006 —

Final Exam

This is a take-home (open text, open class-notes and open Student Guide) final exam. Read carefully the entire exam before attempting to solve any of the problems and then budget your time: do first what you know best. *Show and submit all your work to justify your answers*; wherever appropriate, identify the given data, the applicable formulae, substitutions and results. *Neither discussion of this test with anyone other than the instructor, nor the use of materials other than the text, class notes or the student guide is permitted.* Give proper credit to any source or shortcut you may use. If using computer software to perform calculations, provide sufficient trace for an unambiguous determination of method. By submitting the exam by the **deadline, Wednesday, 12/06/06 7:30 PM**, in class, at the Academic Office of Strayer University of the Manassas Campus or by e-mail (to thubsch@mac.com), you affirm that you have abided by these rules:

.....
Student's full name

Good luck!

(And, may you need none at all!)

Pb.	Pts	Score	Instructor's Comment
1.	10		
2.	20		
3.	30		
4.	40		
Σ	100		

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Problem 1. (10 points)

This table shows the distribution of average times of weekly exercise in your company:

		Exercise time (hours/week)			
		< 1.0	1.0–1.5	1.5–2.0	>2.00
Students:	Female	7	19	43	1
	Male	9	41	27	3

Calculate the probability that:

- any one of your employees, regardless of gender, exercises > 1.0 hrs/week.
- any one of the employees in your company is male.
- any two of your employees (of either gender) each exercises > 1.0 hrs/week.
- any one male *and* any one female employee each exercises > 1.0 hrs/week.
- an employee is male, *provided* that the employee exercises > 1.0 hrs/week.
- an employee is both male *and* exercises > 1.0 hrs/week.

Problem 2. (20 points)

The *TyDye, Inc.* is trying to decide whether to ferment their dye (in a large vat) or to purchase it as needed. The resulting profits depend upon the eventual demand, as shown in the payoff table:

(in \$1,000's) Decision Alternative	Low Demand	Medium Demand	High Demand
	S1	S2	S3
Ferment own, D1	-3	2	11
Purchase as needed, D2	2	4	7

The probabilities for the different demands are: $P(S1) = 0.15$, $P(S2) = .45$ and $P(S3) = 0.40$.

- Determine the decision based on the optimistic (*maximax*), conservative (*minimax*) and optimal (*maximin*) regret approach. For the latter calculate and display the regret table.
- Use a decision tree and expected values (per decision) to recommend a decision.
- A tea-leaf reader's market study of the potential demand for *TyDye, Inc.*'s colorful clothing is expected to report either a groovy (*G*) or boring (*B*) condition. The relevant conditional probabilities then are as follows:
 $P(G | S1) = 0.17$, $P(G | S2) = 0.42$, $P(G | S3) = 0.72$,
 $P(B | S1) = 0.83$, $P(B | S2) = 0.58$, $P(B | S3) = 0.28$.
 Calculate the (marginal) probability that the market research report will be groovy, $P(G)$.
- Describe *TyDye, Inc.*'s optimal strategy, using a decision tree diagram & above data.
- Calculate the expected value of the tea-leaf reader's market research information.

Problem 3. (30 points)

The following table shows the quarterly revenue (in \$1,000's) from an office suite rental:

	2001	2002	2003	2004	2005
Q1	20.93	25.32	32.01	29.07	31.43
Q2	26.82	32.63	35.33	32.23	44.66
Q3	33.29	40.16	45.36	43.89	53.21
Q4	35.57	45.22	49.33	57.51	60.06

- Using 4-quarter moving averages, predict the Q1/2006 revenue.
- Using exponential smoothing, with $\alpha = 0.65$, predict the Q1/2006 revenue.
- Adjust the analysis from part b., using $\beta = 0.45$, and predict the Q1/2006 revenue.
- From the above data, determine the (unmodified) trend function, $T_t = b_0 + b_1t$.
- Determine first the *seasonal factors*, and then use them to adjust the trend function based forecasts for all four quarters of 2006.
- Using MAD, compare the above prediction methods for the Q1/2006 revenue.
- For the original data sequence, calculate the *correlation coefficient* and state its meaning.

Problem 4. (40 points)

Consider the linear programming model where the objective function $Z = 9 \cdot x + 5 \cdot y$, with $x, y \geq 0$, is to be *maximized*, subject to the four constraints:

$$(1) x - 3 \cdot y \leq 0, \quad (2) 7x + 8y \leq 224, \quad (3) 6 \cdot x + 9 \cdot y \leq 180, \quad (4) 3 \cdot x + 4 \cdot y \leq 96.$$

- Carefully construct the feasible region *graphically* and calculate the coordinates of *all* corners. Draw the axes to scale (use graph paper or a plotting software).
- Determine the optimal point and the value of Z at the optimal point either graphically or by computer—but show all work necessary to reach your conclusion.
- Determine the slack/surplus value in each of the constraint for your solution to part b.
- Determine the ranges within which the two coefficients in Z may vary without changing your result in part b.
- Change constraint (1) into $x - 2 \cdot y \leq 0$ and (3) into $5 \cdot x + 9 \cdot y \leq 180$. Determine the effects on the feasible region, optimal point and the value of Z at the (new) optimal point.
- With the linear programming model *changed as in part e.*, restrict now x and y to be integers, and determine the optimal point(s), the value of Z and the slack/surplus for each constraint at the (new) optimal point(s).

You may use *Excel's Solver*, *QM for Excel* and/or *QM for Windows*, but present all your work, reasoning and results (also) graphically, identifying all relevant features on the graphs.