

Name: \_\_\_\_\_

Score: \_\_\_\_\_

- 1(25pts) A sports league does one drug testing of its players. Past data shows 10 percent of its plays used a type of drug the test is designed to catch. Lab research showed that the test is only 95 percent reliable, that is, a lab test subject who was given the drug was tested positive only 95% of the time, and a subject who was not given the drug was tested positive 5% of the time. Develop a probability tree diagram to determine the following probability:

- (a) A player will be tested positive.
- (b) A player is not a drug user but tested positive.

- 2(25pts) The production facility for a publisher of college textbooks is capable of producing 5 different textbooks at a time and the company needs to produce textbooks in 3 subject areas with one textbook minimum for each subject area. The estimated payoff in the unit of \$10,000 to produce different number of textbooks in different areas are given by the following table.

Textbooks	Subject Area		
	1	2	3
1	10	8	9
2	15	12	11
3	18	16	17
4	20	18	19

- (a) Use the *graphical* dynamic programming method to find the number of textbooks to be produced in each subject area so that the total payoff is maximal.
- (b) Solve the same problem *algebraically* by an iterative process for the best payoffs cumulated over the subject areas.

- 3(25pts) A gas station also operates 3 carwash garages. At any time of the day the probability  $P_n$  of having  $n$  cars that are being washed and waiting to be washed is given by the following table:

$n$	0	1	2	3	4	5	6	7	8
$P_n$	0.3	0.25	0.2	0.1	0.05	0.04	0.03	0.02	0.01

- (a) Find the expected number of cars that are being washed at any time.
- (b) If dirty cars arrive at a rate of 6 cars per hours, find the average time in minutes that a car is expected to wait in line for wash.
- (c) If it costs the station 25 cents per minute to wash a car, and the manager likes to add 50% markup for profit, how much should the station charge for one carwash?

- 4(25pts) On Monday, a certain stock closed at \$10 per share. You expect the stock to close at \$9, \$10, or \$11 per share by the end of Tuesday with respective probabilities 0.3, 0.3, and 0.4. You also expect the stock to close 10 percent lower, unchanged, or 10 percent higher than Tuesday's close by the end of Wednesday with the following probabilities

Tuesday's Close	%10 Lower	Unchanged	%10 Higher
\$9	0.4	0.3	0.3
\$10	0.2	0.2	0.6
\$11	0.1	0.2	0.7

All purchases are made at the end of the day, at the known closing price for that day. In the morning of Tuesday, you are directed to buy 100 shares of the stock before Thursday. So your only options are to buy at the end of Tuesday or at the end of Wednesday. You wish to determine the optimal strategy when the closing price is known at the end of Tuesday for whether to buy on Tuesday or defer the purchase until Wednesday to minimize the expected purchase price. Develop and evaluate a decision tree to find the optimal strategy.

**5 Bonus Point Question:** If you must buy in in the morning of Tuesday, what is the expected price that you will pay?