

1. The Table 1 below shows the number of cars Harrisonburg Toyota sold in the last few weeks. Answer the following questions based on the information given in Tables 1:

Table 1. Number of Cars Sold Over Time and Forecasts

	A	B	C	D	E	F	G	H
1	Week	Cars	SMA(3)	WMA(2)	EXP			Weights
2	1	19					W1	
3	2	14					W2	
4	3	12			18.500		Sum	
5	4	13			17.850			
6	5	15			17.365			
7	6	18			17.129		α value	
8	7	16			17.216			
9	8	15			17.094			
10	9	16			16.885			
11	10	13						
12	11							
13	12							
14								

- (1) (5 pts) What is the three – period simple moving average or SMA(3 forecast for the number of cars to be sold in Week 12? (must show the equation and the process for your answer)
- (2) What is the two – period weighted moving average forecast for the number of cars to be sold in Week 12 using the weights 0.4 and 0.6 with the larger weight for the most recent week’s sales data?
- (6 pts.) What is the equation to be used?
  - (6 pts.) What is the Excel@ formula to be used for it in Cell D13?
  - (3 pts.) What is the answer for it? (must show details by putting numbers in the equation and derive the answer)

- (3) What is the Exponential smooth forecast for Week 12 using  $\alpha$  value of 0.1?
- (5 pts.) What is the equation to be used?
  - (5 pts.) What is the Excel@ formula to be used for it in Cell E13?
  - (3 pts.) What is the answer for it? (must show details by putting numbers in the equation and derive the answer)
- (4) How to compute the mean squared error (MSE) for the exponential smoothing forecasts developed for weeks 3 to 9 as given in Table 1 above?
- (6 pts.) What is the equation to be used?
  - (6 pts.) What is the Excel@ formula to be used for it in Cell E14?
- (5) Use the data of car sales and exponential forecasts in Table 1, assume the column F in Table 1 is used to compute the mean absolute percentage forecasting error (MAPE) from weeks 3 to 9, answer the following questions:
- (6 pts) What is the equation to be used to compute MAPE?
  - (6 pts) What is the MAPE for weeks 8 and 9? (must show details and keep at least four decimal points)

-----END of Car Sells Forecasting with SMA, WMA and EXP -----

2. Table 2 below shows the Summary Output for using regression analysis to forecast weekly number of cars sold in the last 100 weeks. Answer the following questions based on the information provided in Table 2.

Table 2. Simple Linear Regression Analysis for Car Sales

	A	B	C	D	E	F	G
1	SUMMARY OUTPUT						
2							
3	<i>Regression Statistics</i>						
4	Multiple R	0.9897					
5	R Square	0.9795					
6	Adjusted R Square	0.9793					
7	Standard Error	7.8728					
8	Observations	100					
9							
10	ANOVA						
11		<i>df</i>					
12	Regression	1					
13	Residual	98					
14	Total	99					
15							
16		<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
17	Intercept	25.9636	1.5864	16.3660	0.0287	22.8154	29.1119
18	Week	1.8671	0.0273	68.4571	0.0147	1.8129	1.9212
19							
20	<i>Week</i>	<i>No. of Cars</i>	<i>Predicted No. of Cars</i>				
21	1	30	...				
22	...	...	...				
23	...	...	...				
24	99	209	...				
25	100	222	...				
26	101						
27							

(1) (10 pts.) What is the general linear model to be used to model the linear trend for the number of cars sold overtime?

(2) Answer the following two questions:

- a. (2 pts) What is the estimated value of  $b_0$ ,

b. (4 pts) How do you interpret the meaning of  $b_0$ ?

(3) You are asked to predict the weekly number of cars to be sold for the week 101:

a. (6 pts.) What is the Excel@ formula of the estimated regression function in Cell C26 of Table 2?

b. (3 pts.) What is the predicted number of cars to be sold in Week 101? (show details)

(4) With Table 2, use the  $p$ -value approach to test the population parameter  $\beta_0$ , and state your conclusion. Assume a significant level of  $\alpha$  value of 5%.

a. (3 pts.) What are the null ( $H_0$ ) and alternative ( $H_1$ ) hypothesis?

b. (5 points) What are the decision rules?

c. (3 pts.) What is your conclusion and what that means to your car sales forecasting?

(5) In terms of the prediction confidence interval:

a. (3 pts.) What is the margin of error for an approximated 95% prediction interval of the number of cars to be sold in Week 101?

b. (5 pts.) What is the approximated 95% prediction interval of number of cars to be sold in Week 101?

----- **END of Car Sales Regression Analysis** -----

3. DukeFan Inc. develops a predictive model to identify buyers and non buyers for its products. Among the 100 customers studied from their database, 30 of them are buyers. The predictive model will put each customer in the study into one of the three groups: identified as buyer, identified as non buyer and identified as inconclusive. When the predictive model is applied to buyers, it successfully identifies buyers 75% of times, 11% of times as inconclusive and the rest as non buyers. When the predictive model is applied to non buyers, it successfully identifies non buyers 85% of times, and 7% of time as buyers.

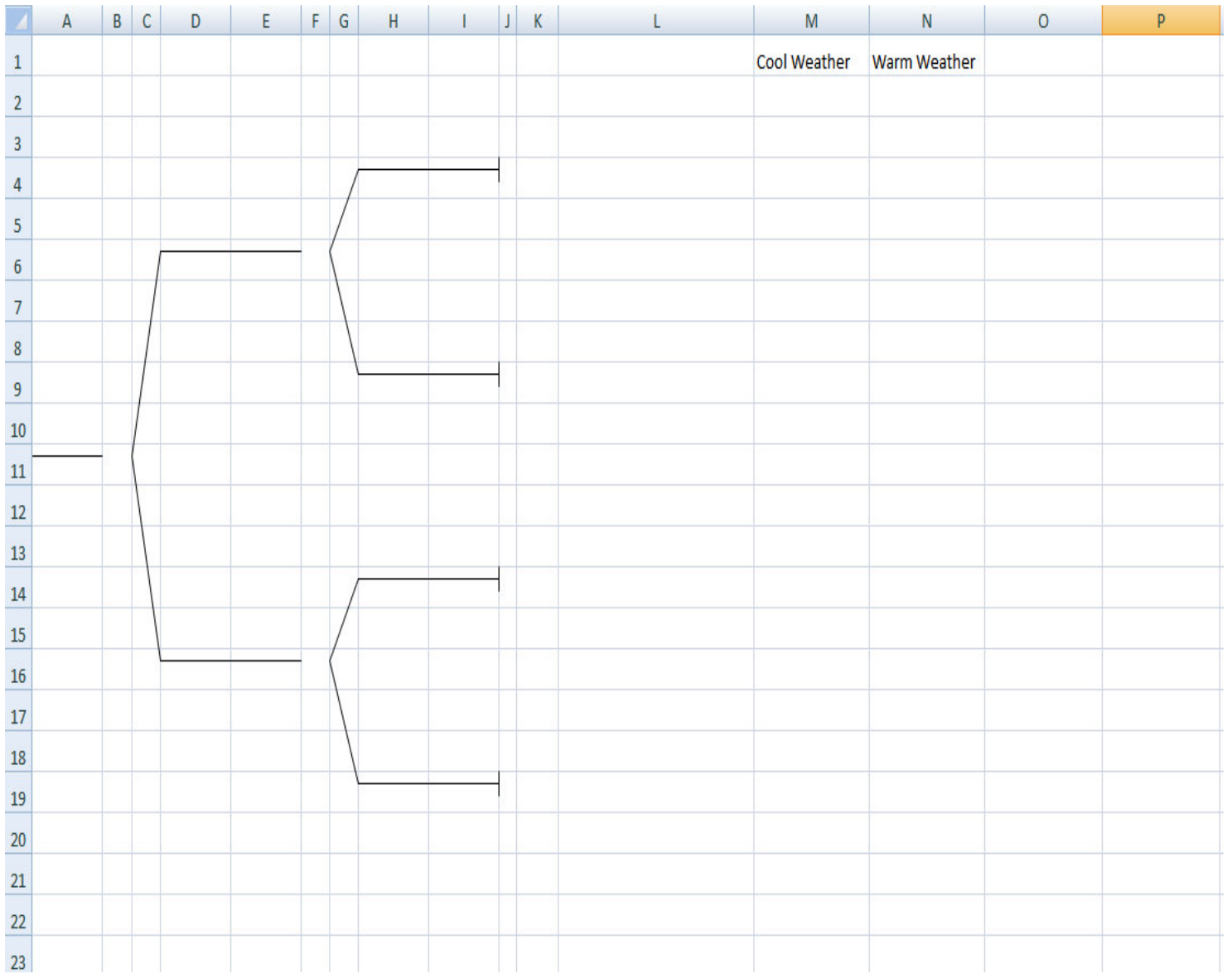
(1) (10 pts.) Use the information provided in the problem above to fill the tables below with prior probability, conditional probability, joint probability and posterior probability, each with 3-decimal points of accuracy. (must show details with equations and appropriate notations)

	A	B	C	D	E	F
1			Buyers	Non Buyers		
2		Prior Probability				
3						
4						
5		Conditional	Buyers	Non Buyers		
6						
7						
8						
9						
10						
11		Joint	Buyers	Non Buyers		
12						
13						
14						
15						
16						
17		Posterior	Buyers	Non Buyers		
18						
19						
20						
21						
22						

- (2) (3 pt) Based on your results above, what is the probability that a randomly selected customer is a non buyer? (must show details with equations and appropriate notations)
- (3) (4 pts.) Based on your results above, among the buyers, what is the probability that a randomly selected customer is identified as non buyer? (must show details with equations and appropriate notations)
- (4) (4 pts ) Based on your results above, what is the probability that a randomly selected customer is either a buyer or is identified as buyer? (must show details with equations and appropriate notations)
- (5) (4 pts.) Based on your results above, among those identified as non buyers, what is the probability that a randomly selected customer is actually a buyer? (must show details with equations and appropriate notations)

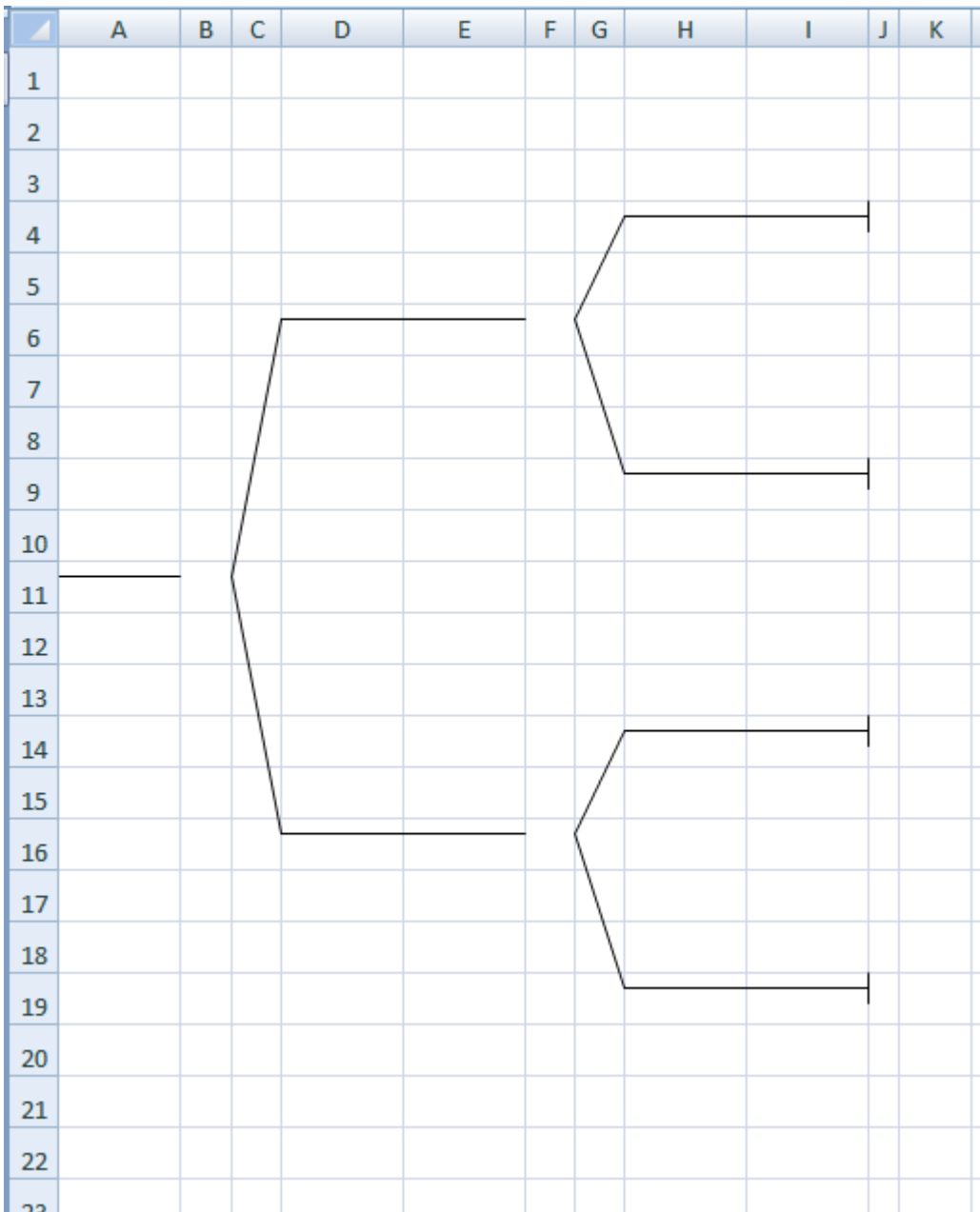
----- **END of DukeFan Problem** -----

4. A vendor at Bluestone Stadium must determine whether to sell ice cream or soft drinks at Saturday's game. The vendor believes that the profit made will depend on the weather. For a cool weather, she can make \$50 if she sells soft drinks, and she can make \$30 if she sells ice cream. For a warm weather, she can make \$60 if she sells soft drinks, and she can make \$90 if she sells ice cream. Based on her past experience at this time of year, the vendor estimates the probability of warm weather as 0.60.
- (1) With the information given in the problem above, you may use either a payoff table or a decision tree when you answer the following questions. A portion of Excel spreadsheet is provided for your convenience. You must show details with appropriate equations and terms and keep 3 decimal points.
- a. (5 pts) What is the payoff table for the problem? You may use the blank table on the next page.
  
  
  
  
  
  
  
  
  
  
  - b. (6 pts) Construct the decision tree to find expected monetary values (EMV) and max EMV for the problem. You may use the structure of the tree on the next page.
  
  
  
  
  
  
  
  
  
  
  - c. (10 pts.) What is the maximum or optimal expected profit (EMV) = \_\_\_\_\_? (You must show details)
  
  
  
  
  
  
  
  
  
  
  - d. (4 pts.) What is the optimal strategy for the vendor and why?



(2). What is EVwPI and EVPI?

- a. (8 pts) Construct the decision tree to find the expected value with perfect information (EVwPI) for the problem.
  
  
  
  
  
  
  
  
  
  
- b. (3 pts.) What is the expected value of perfect information (EVPI) for the problem? (You must show details)



- (2) Given the expanded decision tree for expected value with weather information (EVwSI) below, some of the entries on the tree are taken out. Assume she pays \$5 for a reliable weather report.
- (10 pts) Compute EVwSI and EVSI for the problem. You must show details.
  - (3 pts) Compute the efficiency of the sample information and discuss your findings. You must show details.
  - (3 pts) What choice would you recommend to the vendor for the whole situation (with or without weather forecast) and why?

