STA 250 (Spring 13): Midterm III

Total time: 1hr 10min

The **three** questions below carry a total of 30 points. Attempt all questions and show details of work to guarantee partial/full credit. Make use of the tables and basic probability facts attached at the end. **No other cheat sheets allowed**. You will be provided with sheets of white paper to write your answers on. Please remember to staple them before turning in and write your name on the top. You should be able to attempt any part of any question whether or not you have attempted the parts before it.

1. A count data X is modeled as $X \sim f(x|\theta)$, $\theta \in \{0, 1\}$, where the pmfs $f(x|\theta)$, defined over $x \in \{1, 2, 3\}$ (i.e., $f(x|\theta) = 0$ for any other x) are as in the table below.

θ	$f(1\|\theta)$	$f(2\|\theta)$	$f(3\|\theta)$
0	0.9	0.05	0.05
1	0.09	0.055	0.855

For inference on θ, answer the following. [$6 + 4 = 10$ points]

(a) Calculate the confidence coefficient of the interval rule $A(x)$ given by:

$$A(1) = \{0, 1\}, \quad A(2) = \{0\}, \quad A(3) = \{1\}.$$

(b) Is the above interval rule an ML interval rule? Justify your answer.

2. A hospital in Houston ran an experiment to judge comparative effectiveness of early versus delayed injection of IV fluids to victims of stab injury to the torso. In 309 randomly selected cases, patients were given IV fluids on their way to the hospital and 189 of them survived. In another 289 cases patients got the fluids only after reaching the operation theater and 203 of them survived. Test at level 5% the null hypothesis that chance of survival is unaffected by the timing of IV injection. Give details of how you formalized your test (including model and method for testing) and also details of your calculations. [10 points]

3. The swing (difference between the maximum and minimum values) of S&P500 on any one day is distributed with pdf $f_1(x) = \frac{2}{20(1+x/20)^3}$, $x > 0$ if the market that day is "stable" or as $f_2(x) = \frac{2}{200(1+x/200)^3}$ if the market "enters a volatile period". At the beginning of Apr 11, 2013, a market analyst assigns 1/8 chance to the market entering a volatile period on that day. The loss associated with flagging the day as "entered a volatile period" (flag V) or "stayed stable" (flag S) are given below.

		Truth about Apr 11, 2013	
		'Entered a volatile period'	'Stayed stable'
Flag	V	0	1
	S	10	0

Let X denote the swing to be recorded for Apr 11, 2013. [$4 + 6 = 10$ points]

(a) For $X = 30$ standard posterior calculations show

$$\frac{P(\text{stayed stable}|X = 30)}{P(\text{entered a volatile period}|X = 30)} = 6.81.$$

Should the analyst flag Apr 11, 2013 as "stayed stable" if $X = 30$ was recorded on the day? Justify your answer.

(b) What is the maximum value of X for which the analyst will (retrospectively) flag the day as "stayed stable"? Show details of your calculations.