Name: ____________________________

Directions: **Work only on this sheet** (on both sides, if needed); do not turn in any supplementary sheets of paper. There is actually plenty of room for your answers, as long as you organize yourself BEFORE starting writing.

Unless otherwise stated, give numerical answers as expressions, e.g. $\frac{2}{3} \times 6 - 1.8$. Do NOT use calculators.

1. (35) Consider the lottery ticket example on pp.147ff. Suppose 500 tickets are sold, and you have data on 8 of them. Continue to assume sampling with replacement. Fill in the blank: The probability that the MLE is exactly equal to the true value of c is 1 - ________________________________.

2. In an analysis published on the Web (Sparks *et al*, Disease Progress over Time, *The Plant Health Instructor*, 2008, the following R output is presented:

```
> severity.lm <- lm(diseasesev~temperature,data=severity)
> summary(severity.lm)
Coefficients:
        Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.66233    1.10082   2.418  0.04195 *
temperature  0.24168    0.06346   3.808  0.00518 **
---
Signif. codes:  0 *** 0.001 ** 0.01 * 0.05 . 0.1   1
```

Fill in the blanks:

(a) (15) The model here is

______________________ ______________________ $= \beta_0 + \beta_1$ ______________________

(b) (15) The two null hypotheses being tested here are H_0 : ______________________ and H_0 : ______________________.

3. Let X denote the number we obtain when we roll a single die once. Let $G_X(s)$ denote the generating function of X.

(a) (20) Find $G_X(s)$.

(b) (15) Suppose we roll the die 5 times, and let T denote the total number of dots we get from the 5 rolls. Find $G_T(s)$.

Solutions:

1.

$$1 - \left(\frac{499}{500}\right)^8 \tag{1}$$

2a. mean, diseasesev, temperature (the word *mean* is crucial)

2b. $H_0 : \beta_0 = 0$, $H_0 : \beta_1 = 0$

3a.

$$G_X(s) = \sum_i s^i P(X = i) = \frac{1}{6} \cdot (s + s^2 + s^3 + s^4 + s^5 + s^6) \tag{2}$$

3b. Write $T = X_1 + ... + X_5$. Then

$$\begin{aligned} G_T(s) &= G_{X_1+...+X_5}(s) && (3) \\ &= G_{X_1}(s)...G_{X_5}(s) && (4) \\ &= [G_X(s)]^5 && (5) \\ &= \left[\frac{1}{6} \cdot (s + s^2 + s^3 + s^4 + s^5 + s^6)\right]^5 && (6) \end{aligned}$$