1. (5.5.13) Let $p$ denote the probability that, for a particular tennis player, the first serve is good. Since $p = .4$, this player decided to take lessons in order to increase $p$. When the lessons are completed, the hypothesis $H_0 = p = .4$ will be tested against $H_1 : p > .4$ based on $n = 25$ trials. Let $y$ equal the number of first serves that are good, and let the critical region be defined by $C = \{y : y \geq 13\}$

   (a) Determine $\alpha = P_{p=.4}(Y \geq 13)$.

   (b) Find $\beta = P_{p=.6}(Y < 13)$. That is $1 - \beta$ is the power at $p = 0.6$.

2. (5.6.2) Consider the power function $\gamma(\mu)$ and its derivative given by (5.6.5). Show that $\gamma'(\mu)$ is strictly negative for $\mu < \mu_0$, and strictly positive for $\mu > \mu_0$. What does this mean about $\gamma(\mu)$?

3. (5.6.9) In exercise 5.4.14, (on HW 2) we found a confidence interval for the variance $\sigma^2$ using the variance $S^2$ of a random sample of size $n$ arising from $N(\mu, \sigma^2)$, where the mean $\mu$ is unknown. In testing $H_0 : \sigma^2 = \sigma_0^2$ against $H_1 : \sigma^2 > \sigma_0^2$, use the critical region defined by $(n - 1)S^2/\sigma_0^2 \geq c$. That is, reject $H_0$ and accept $H_1$ if $S^2 \geq c\sigma_0^2/(n - 1)$. If $n = 13$ and the significance level $\alpha = 0.025$, determine $c$.

4. (5.7.3) A die was cast $n = 120$ time independent times, and the following data resulted:

<table>
<thead>
<tr>
<th>Spots Up</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>$b$</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>40 $- b$</td>
</tr>
</tbody>
</table>

If we use a chi-square test, for what values of $b$ would the hypothesis that the die is unbiased be rejected at the 0.025 significance level.
5. (5.7.7) A certain genetic model suggest that the probabilities of a particular trinomial distribution are, respectively, \( p_1 = p^2, p_2 = 2p(1-p) \) and \( p_3 = (1-p)^2 \), where \( 0 < p < 1 \). If \( X_1, X_2, X_3 \) represent the respective frequencies in \( n \) independent trials, explain how we could check on the adequacy of the genetic model.

6. (5.8.3). Suppose \( X \) is a random variable with the pdf \( f_X(x) = b^{-1} f\left(\frac{x - a}{b}\right) \), where \( b > 0 \). Suppose we can generate observations from \( f(z) \). Explain how we can generate observations from \( f_X(x) \).

**Remark:** I promised some test-like questions, but the book questions are pretty good in this regard this time - especially 1, 3, 4. Even problems like 5 written a bit less open endedly is okay. 6, I would try and make more concrete. As I hit sections where the book problems are less suitable for exam problems, though, I will try and write some of my own problems. Please give me feedback as to whether how the homework problems are going for you as we head towards this exam.