Stating Hypotheses

1. Mississippi Department of Motor Vehicle (DMV) records indicate that of all vehicles undergoing emissions testing during 2009, 70% passed on the first try. Late in 2009 the state implemented a program designed to encourage preventative service to improve emissions compliance. Does this program work?

2. At one school, Math 167 is a prerequisite for Math 267. Experience has shown that the mean GPA in Math 267 is 2.674 for those students who take Math 167 on campus. Universities typically grant students transfer credit for courses taken elsewhere. The math department wants to know if students who get credit for Math 167 via transfer credit perform differently on average in Math 267 than those who take Math 167 on campus.

3. Some couples turn to the right, and some turn to the left, when they kiss. Can we show that a majority turn in one direction?

4. Researchers sent resumes in response to job ads that appeared in the *Boston Globe* and *Chicago Tribune*. The resumes were identical except that half of them had “white sounding” first names (such as Brett and Emily), whereas the other half had “black sounding” first names (such as Tamika and Rashid). Is a resume with a “black” name less likely to result in an interview than is a resume with a “white” name?

5. A student project by Heather Kral studied students on “lifestyle floors” of a dormitory in comparison to students on other floors. On a lifestyle floor the students share a common major, and there are a faculty coordinator and resident assistant from that department. Is the mean GPAs for students on lifestyle floors higher than that for students on other floors? Is the amount of variability in GPA among students on lifestyle floors less than that for other floors?

6. Is the maltreatment rate among internationally adopted children as a group below that of children who are biological conceived by their parents?
7. Census data suggests that in the early 1960s, 25% of those eligible for grand jury service in Alabama were black. A civil rights lawyer alleges that there has been discrimination against blacks in the actual grand jury selection (which is supposed to be done at random).

8. Census Bureau data show that the mean household income in the area served by a shopping mall is $62,500 per year. A market research firm questions shoppers at the mall to find out whether the mean household income of mall shoppers is higher than that of the general population.

9. Last year, your company’s service technicians took an average of 2.6 hours to respond to trouble calls from business customers who had purchased service contracts. Do this year’s data show a different average response time?

10. A city needs $32,000 in annual revenue from parking fees. Parking is free on weekends and holidays; there are 250 days in which parking is not free. This implies that the daily revenue must average $128 or more over the long run.

   Officials initially set rates on the low end of a range that is thought to bring in sufficient revenue. After a trial period they want to determine whether too little revenue is being collected (in which case they will be forced to raise rates).

11. A national survey of restaurant employees found that 75% said that work stress had a negative impact on their personal lives. As manager of a chain of restaurants, you are curious whether your employees respond differently than do those nationwide.

12. An office manager wants to explore the following issues:

   Are men more likely than women to steal office supplies?

   Do women take a longer lunch than men, on average?
Solutions

1. $H_0: \ p = 0.7 \quad H_1: \ p > 0.7$
   
   $p$ = the proportion of all cars that currently pass on the first try

2. $H_0: \ \mu = 2.674 \quad H_1: \ \mu \neq 2.674$
   
   $\mu$ = the mean Math 167 GPA of all transfer students

3. $H_0: \ p = \frac{1}{2} \quad H_1: \ p \neq \frac{1}{2}$
   
   $p$ = the proportion of all couples who turn to the right (or to the left)

4. $H_0: \ p_B = p_W \quad H_1: \ p_B < p_W$
   
   $p_B$ = the proportion of all blacks who get an interview
   $p_W$ = the proportion of all whites who get an interview

5. $H_0: \ \mu_L = \mu_O \quad H_1: \ \mu_L > \mu_O$
   
   $\mu_L$ = the mean GPA of all students on lifestyle floors
   $\mu_O$ = the mean GPA of all students on other (not lifestyle) floors

   $H_0: \ \sigma_L = \sigma_O \quad H_1: \ \sigma_L > \sigma_O$
   
   $\sigma_L$ = the standard deviation of GPAs of all students on lifestyle floors
   $\sigma_O$ = the standard deviation of GPAs of all students on other (not lifestyle) floors

6. $H_0: \ p_A = p_B \quad H_1: \ p_A < p_B$
   
   $p_A$ = the proportion of all adopted children who are maltreated
   $p_B$ = the proportion of all biological children who are maltreated

7. $H_0: \ p = 0.25 \quad H_1: \ p < 0.25$
   
   $p$ = the proportion of all grand jury selections who are black (i.e. the probability a grand juror is black)

8. $H_0: \ \mu = 62500 \quad H_1: \ \mu > 62500$
   
   $\mu$ = the mean household income of all mall shoppers

9. $H_0: \ \mu = 2.6 \quad H_1: \ \mu \neq 2.6$
   
   $\mu$ = the mean response time (for all trouble calls) this year

10. $H_0: \ \mu = 128 \quad H_1: \ \mu < 128$
    
    $\mu$ = the mean daily parking revenue (for all days going forward)

11. $H_0: \ p = 0.75 \quad H_1: \ p \neq 0.75$
    
    $p$ = the proportion of all restaurant employees who say work stress has a negative impact

12. $H_0: \ p_M = p_W \quad H_1: \ p_M > p_W \quad H_0: \ \mu_W = \mu_M \quad H_1: \ \mu_W > \mu_M$
    
    $p$ = the proportion of all [M = men; W = women] who steal office supplies
    $\mu$ = the mean time spent taking lunch for all [M = men; W = women]

This works too: $H_0: \ p = 0.3 \quad H_1: \ p < 0.3$

$p$ = the proportion of all cars that currently do not pass on the first try