Math 121 **Test #1** **Spring 2008**

1. (20 pts)

   (a) An explanatory variable is the amount of slow-wave sleep the person gets. A response variable is the person's ability to process sugar.

   (b) This is an experiment because the researchers are manipulating the amount of slow-wave sleep that the subject gets.

   (c) (4 pts) Appropriate hypotheses are

   H_0: People who get little slow-wave sleep process sugar just as well as people who get the normal amount of slow-wave sleep.

   H_1: People who get little slow-wave sleep do not process sugar as well as people who get the normal amount of slow-wave sleep.

   (d) The alternative hypothesis seems to be supported. The article doesn't say so in so many words, but that is certainly the implication.

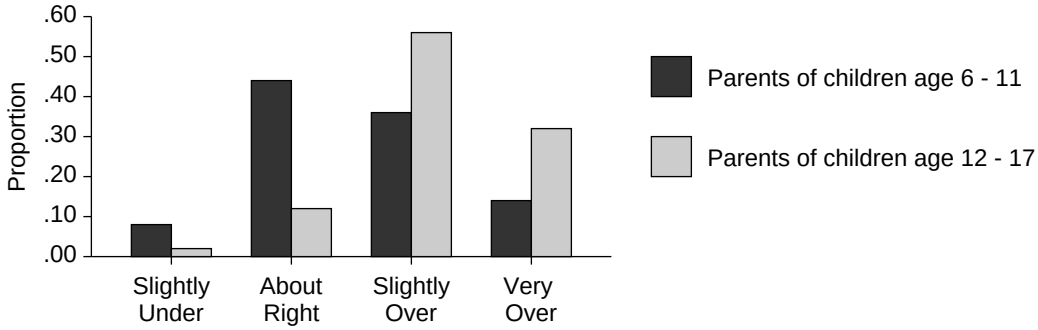
   (e) A Type I error would be to conclude that people with less slow-wave sleep do not process sugar as well as people with a normal amount of slow-wave sleep when, in fact, they process it just as well.

2. (a) The population of interest is all parents of obese children.

   (b) The variable is the parent's perception of his or her child's weight. The possible values are "about the right weight," "slightly overweight," "very overweight," and "slightly underweight."

   (c) The variable is qualitative.

   (d) The most appropriate display is a bar graph with a pair of bars for each category, one bar for parents of children age 6 to 11 and another bar for parents of children age 12 to 17.



   (e) The most obvious type of bias is response bias. The study indicates that parents have a significant tendency to underestimate their child's weight. That is because overweight children are stigmatized.

3. (16 pts)

   (a) The 21% figure is a *statistic* because it was calculated from a sample.

   (b) This method of sampling would be *stratified* sampling.

   (c) This would be a sensible way to select a sample because it is reasonable to believe that a person's religious practices would influence his opinion about stem-cell research. The strata would be homogeneous with regard to religious practice and that is likely a relevant variable.

   (d) To select a simple random sample, we first enter `142→rand` into the TI-83. Then enter the expression `randInt(1,1500)` and hit `ENTER` five times.

4. (4 pts) Use the percentages to calculate the number of people in each category. Then add them up and divide by the total:

$$\begin{aligned} 13\% \times 301 &= 39.13 \\ 5\% \times 280 &= 14.00 \\ 11\% \times 341 &= 37.51 \end{aligned}$$

   The total is 90.64 out of 922, for an overall percentage of $90.64/922 \times 100\% = 9.831\%$.

5. (a) The direction of extreme is to the right. In that direction, the values under the null hypothesis become less likely and the values under the alternative hypothesis become more likely.

   (b) Count the number of X's at or to the right of "strongly disagree" in the H_0 picture. There are 2 out of 25, so $\alpha = \frac{2}{25} = 0.08$.

   (c) To find β, use the H_1 picture and count the number of X's to the left of "strongly disagree." There are 18, so $\beta = \frac{18}{25} = 0.72$.

   (d) Compute this in the same manner as α, except use "disagree" instead of "strongly disagree." We get p-value$= \frac{8}{25} = 0.32$.

   (e) A Type II error would be to conclude that you are in the room full of Republicans when, in fact, you are in the room full of Democrats.

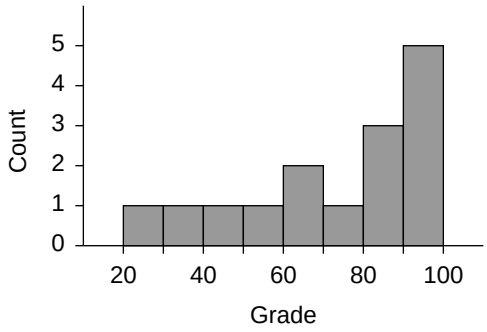
6.

Std	Scr	Std	Scr	Std	Scr	Std	Scr	Std	Scr	Std	Scr
1	79	11	88	21	100	31	63	41	77	51	66
2	51	12	92	22	100	32	100	42	74	52	56
3	64	13	95	23	65	33	97	43	84	53	100
4	69	14	80	24	90	34	70	44	70	54	77
5	72	15	57	25	100	35	90	45	28	55	100
6	53	16	24	26	84	36	37	46	98	56	79
7	83	17	100	27	62	37	90	47	79	57	66
8	96	18	71	28	100	38	96	48	50	58	42
9	78	19	85	29	92	39	78	49	64	59	76
10	100	20	85	30	93	40	87	50	100	60	100

(a) Set the seed using `362→rand`. Then enter `randInt(1,4)` and press `ENTER`. The result is 4. So, beginning with student #4, select every 4th student. That gives the sample

$$\{69, 96, 92, 24, 85, 90, 100, 100, 37, 87, 70, 50, 56, 79, 100\}.$$

(b) A convenient choice is to use the classes $[21, 30)$, $[31, 40)$, ..., $[91, 100)$. That way, 100 gets included in the last class. There are many other choices. For example, $[20, 29)$, $[30, 39)$, ..., $[90, 99)$, $[100, 109)$. That choice is ok, but it puts 100 in a class by itself (literally). Here is the histogram for the first choice:



7. (a) The main problem is that teenagers will not be honest about their drug use if they are using drugs. This is response bias. To minimize this, the researchers could use the results of drug tests. Of course, that comes with its own set of problems.

(b) If the researchers let the patients volunteer, then there is the likelihood that the sicker patients will be more likely to volunteer because their situation is more urgent. This would be selection bias (not all individuals are equally likely to be selected).

(c) The most obvious problem here is non-response bias. Most people throw mailed surveys in the trash. The ones who do not are probably not representative of the population at large.