Statistics 410, Fall 2011

Solutions to homework 1, due 9/28/11

1.2 We are making 4 independent observation of weight, so our total weight should be $4 \cdot 30 = 120$ grams give or take the Pythagorean "sum" for the error terms. Each standard error is 5 grams, so the "give or take" figure for the sum is

$$\sqrt{5^2 + 5^2 + 5^2 + 5^2} = 10.$$

1.3 As in the example, we assign the value 1 to the digits $0, 1, 2, 3, 4, 5$ and the value 0 to the digits $6, 7, 8, 9$.

For our 4 "samples" we use rows 4, 9, 17 and 25 in columns 1-25. This gives us 12 1s in the first sample, 13 1s in the second sample, 20 1s in the third sample, 10 1s in the fourth sample.

(a) So our percentages are

$$.48, .52, .8, .4$$

and the average is .55.

(b) The average random sampling error is

$$\frac{-.12 - .08 + .2 - .05}{4} = -.0125$$

(c) The mean of the absolute values is

$$\frac{.12 + .08 + .2 + .05}{4} = .1125$$

(d) The root mean square is

$$\sqrt{\frac{.12^2 + .08^2 + .2^2 + .05^2}{4}} = \sqrt{\frac{.0144 + .0064 + .04 + .0025}{4}} = \sqrt{\frac{.0633}{4}} = \frac{.252}{2} = .126$$

1.7 (a) By the formula (1.1), we have

$$SE_p \leq \frac{1}{2\sqrt{n}}.$$

So if we make sure $\frac{1}{2\sqrt{n}} \leq .05$, then our standard error will also be less than .05.

Solving $\frac{1}{2\sqrt{n}} = .05$ gives first $\frac{1}{4n} = .0025$ and then inverting gives $4n = 400$ so $n = 100$.

(b) To make sure the 95% margin of error is less than or equal to .05, we note that by the discussion on the top of p. 9, the 95% confidence margin of error is roughly twice the standard error. So we need the standard error to be less than or equal to .025. So

$$\frac{1}{2\sqrt{n}} = .025 \text{ gives } \frac{1}{4n} = .000625 \text{ and } 4n = 1600$$

so $n = 400$.

Note that you will get a slightly different answer if you use the more accurate approximation that the 95% confidence margin of error is roughly 1.96 times the standard error.

(c) To get a margin of error $\leq .05$ at 99.7% confidence, we use that the margin of error (again, top of p.9) will be about 3 times the standard error. So we'll want the standard error to be less than or equal to $.05/3 = .0167$.

$$\frac{1}{2\sqrt{n}} = .0167 \text{ gives } \frac{1}{4n} = .00028 \text{ and } 4n = 3571.4.$$

So we want $n \geq 893$.

1.10 The symbol for the parameter is π, the value of the parameter is *unknown*. Th collection of 1010 registered voters is called the *sample*. The symbol for the statistics is p. The value of the statistics is 45%. The 95% margin of error is approximately 3%.