Math 1070-2: Spring 2008
Lecture 8

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Partial solutions to the last assignment
#6.46. Migraine Headaches

- For people with occasional migraine, $p = 0.60$ is the proportion who get relief from Ibuprofen. For a particular subject, let $x = 1$ if they get relief, and $x = 0$ if they do not. For a random sample of 24 people who suffer from migraines:
  - State the probab. dist. for each observation
  - Find the mean of the sampling dist. of the sample proportion who get relief
  - Find the standard error of the sampling dist. of the sample proportion
  - Explain what the standard error describes

- ▶ Sample size 3160 (discussed also in lecture); should Gov. Davis be recalled from the office? Suppose 55% of *all* voters voted for the recall.
  - ▶ Suppose the mean and SE of the sampling dist. of the proportion of the 3160 people were resp. 0.55 and 0.0089. Give an interval of values within which the sample proportion will almost certainly fall.
  - ▶ Based on the prev. part's result, if you take an exit poll and observe a sample proportion of 0.6, would you be safe in concluding that the population proportion probably exceeds 0.55? Why?

Partial solutions to the last assignment
#6.56. Canada lottery

- You bet a six-digit number between 000000 and 999999. For a \$1 bet, you win \$100,000 if you guess correctly. The mean and SD of the probab. dist. for the winnings are $\mu = 0.100$ and $\sigma = 31.623$ dollars. Let $\bar{x}$ denote Joe's average winnings after one million lotteries.
    - Find the mean and SE of the sampling dist. of the average winnnings of Joe.
    - What are the chances that Joe's average winnings exceeds \$1?

- BP monitored by taking three readings per day. [Assume the successive observations $\approx$ random sample]
  - The mean of the probab. dist. of BP is 130, and the SD is 6. Find the mean and SE of the sampling dist. of the sample mean for the three observations/day.
  - Suppose the probab. dist. of BP is normal. What is the shape of the sampling distribution? Why?
  - Refer to the prev. part. Find the probab. that the sample mean exceeds 140.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

Confidence intervals

- A **point estimate** is a single number that is our "best prediction" for the parameter of interest. [Natural]
- An **interval estimate** is an interval of numbers within which the parameter value is believed to fall. [Requires math]
- **Example:** Avg. ht. was 70" in a random sample of size 100. Point estimate for the actual "population height" is 70 inches
- **Example:** In a random sample of 500, 45% voted for Party X. Point estimate for the percentage of votes, in that population, for Party X is 45%
- **Goal:** Given a certain percentage (say 98%), find a random interval that contains the parameter with probability at least that percentage.

Confidence intervals for proportions
not on the next midterm

- $\hat{p}$ = "p hat" = sample proportion
- Then,

$$\hat{p} \pm (\ell \times SE) = \hat{p} \pm \left(\ell \times \sqrt{\frac{p(1-p)}{n}} \right)$$

- What is ℓ? [for 95%, $\ell = 1.96$; for 99%, $\ell = 2.58$]
- A good approximation:

$$\hat{p} \pm \left(\ell \times \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \right)$$

An example

- A market survey organization took a simple random sample of 500 households in a certain town with 25,000 households: 79 of the sampled households had computers. Is it possible to find a 95% CI for the percentage of all 25,000 households with computers?
  - You bet it is possible!
  - $\hat{p} = 79/500 = 0.158$ [$\approx 15.8\%$; point estimate for p]
  - SE:
  $$SE \approx \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \approx 0.0163$$
  - 95% CI for p:
  $$0.158 \pm (1.96 \times 0.0163) = 0.158 \pm 0.031948$$
  - p is somewhere between $0.126 = 12.6\%$ and $0.19 = 19\%$ [95% confidence = ????]