Statistics for the Life Sciences

Math 20340 Section 01, Fall 2009

Homework 5 Solutions

- **6.3**:
  - **a**: .9452
  - **b**: .9664
  - **c**: .8159
  - **d**: almost 1
- **6.5**:
  - **a**: $= P(z \leq .68) - P(z \leq -1.43) = .6753$
  - **b**: .2401
  - **c**: .2694
  - **d**: $= 1 - P(z \leq 1.34) = .0901$
  - **e**: almost 0
- **6.13**:
  - **a**: .1596
  - **b**: .1151
  - **c**: .1359
- **6.15**: $(x - 35)/10$ is a standard normal; the value for a standard normal that has .01 to its right is 2.33; so x can be either the solution to $(x - 35)/10 = 2.33$ of that number which is 2.33 standard deviations above 35; either way $x = 58.3$.
- **6.17**: $(x - \mu)/\sigma$ is z; $P(z \geq -2) = .9772$ and $P(z \geq -1.5) = .9332$. So we know that when we plug in $x = 4$ to $(x - \mu)/\sigma$ we get -2, and when we plug in $x = 5$ we get -1.5. This gives two equations in two unknowns: $4 - \mu = -2\sigma$ and $5 - \mu = -1.5\sigma$. The solution is $\sigma = 2$ and $\mu = 8$.
- **6.19**: Let x be height of randomly selected man. x is normal with mean 69, standard deviation 3.5. Standardizing, $(x - 69)/3.5$ is a standard normal.

- **a**: Taller than $6'$ is same as taller than 72 inches, that is 4 inches or $3/3.5 = .857$ standard deviations above mean. $p(z > .857) = .1949$, so about 12.7% of men are $6'$ or taller
- **b**: $p(5'8" \leq x \leq 6'1") = p(68 \leq z \leq 73) = p(-1/3.5 \leq z \leq 4/3.5) = p(-.29 \leq z \leq 1.14) = .487$
- **c**: $5'11"$ is 71 inches, only .57 standard deviations from the mean; not unusual
- **d**: $18/42 = .428$ is observed proportion among presidents; .127 is proportion among general population. Observed proportion does seem unusual

- **6.23**:
  - 1300 is 1.01 standard deviations above mean; probability of exceeding this is .1562
  - 1500 is 3.03 standard deviations above mean; probability of exceeding this is .0012

- **6.29**: More than 100 is more than $15/9 = 1.66...$ standard deviations above mean. Probability of this is .0475

- **6.31**: Say publisher specifies X words. The number provided is a normal x with mean $X + 20000$, standard deviation 10000. The probability that there will be fewer than 100000 words is

  $$P(x \leq 100000) = P(z \leq (100000 - X - 20000)/10000) = P(z \leq (80000 - X)/10000).$$

  We want this to be .95; since $P(z \leq 1.645) = .95$, we want $(80000 - X)/10000 = 1.645$ or $X = 63550$.

- **6.37**:
  - **a**: Yes, because $np, nq > 5$.
  - **b**: $\mu = np = 7.5$, $\sigma = \sqrt{npq} = 2.29....$
  - **c**: Using continuity correction, we calculate $P(5.5 \leq x \leq 9.5)$ where x is normal, mean 7.5, standard deviation 2.29, and get .6156.
  - **d**: Exact probability .618; not bad!

- **6.47**: Number x of no-shows is a binomial distribution with $n = 215$, $p = .1$, so mean 21.5 and standard deviation close to 4.4. We want $P(x \geq 15)$; using continuity correction we estimate by $P(x \geq 14.5)$ where x is normal with mean 21.5, standard deviation 4.4 and get probability .9441.

- **7.5**: If we assume that *everyone* in the town passes the corner, then yes. But perhaps, busy as it might be, not all of the population passes by that corner; for example, elderly people who are home-bound might not be included in sample.

- **7.7**: Certainly not everyone who is over 18 is registered to vote; a lot of younger people are not, for example. That slack could be picked up by the drivers licence records, since almost everyone has either a drivers licence or a DMV-issued state ID.