HW09 - Probability Histograms and Sampling

Stat 20 & 131A, Spring 2017, Prof. Sanchez

Due Mar-23

1) A coin is tossed 100 times. Use normal approximation (with continuity correction) to estimate the chance of getting 60 heads. Please show your work (no work, no credit). $_{0.5pts}$

2) Show your work. A coin is tossed 10,000 times. Estimate the chance of getting: $_{1.5pts}$

a. 4,900 to 5,050 heads.

b. 4,900 heads or fewer.

c. 5,050 heads or more.

3) Four hundred draws will be made at random with replacement from the box `[1, 3, 5, 7]` $_{2pt}$

a. Estimate the chance that the sum of the draws will be more than 1654.

b. Estimate the chance that there will be fewer than 85 `5`'s.

4) A coin is tossed 25 times. Use the normal approximation to get an estimate of the chance of getting between 10 and 15 heads exclusive. Please show your work (no work, no credit) $_{0.5pts}$

5) A biased coin has one chance in ten of landing heads. It is tossed 500 times. Estimate the chance of getting exactly 50 heads. Show your work (no work, no credit) $_{0.5pts}$

6) A coin is tossed 1,000 times. There are two options:

i. To win $1 if the number of heads is between 490 and 510.

ii. To win $1 if the percentage of heads is between 48% and 52%.

Which option is better. Or are they the same? Explain. $_{0.25pts}$

7) A pair of dice are thrown. The total number of spots is like:

a. One draw from the box: `[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]`.

b. The sum of two draws from the box: `[1, 2, 3, 4, 5, 6]`.

Explain. $_{0.25pts}$

8) Ten thousand draws are made at random with replacement from a box with ninety-nine tickets marked `0` and one ticket markerd `1`. True or false, and explain. $_{0.5pts}$

a. The sum will be around 100, give or take or so.

b. There is about 68% chance that the sum will be in the range 90 to 110.

9) One hundred draws were made at random with replacement from a box containing 2000 marbles; 800 of which are white, and the others, black. The number of white marbles among the draws was counted. The first 10 counts were: 37, 38, 35, 36, 31, 39, 33, 36, 30, 34. Is anything fishy? Answer yes or no, and explain. $_{0.5pts}$

10) A survey is carried out by the finance department to determine the distribution of household size in a certain city. They draw a simple random sample of 1,000 households. After several visits, the interviewers find people at home in only 653 of the sample households. Rather than face such a high non-response rate, the department draws a second batch of households, and uses the first 347 completed interviews in the second batch to bring the sample up to its planned strerngth of 1,000 households. The department counts 3,087 people in these 1,000 households, and estimates the average household size in the city to be about 3.1 persons. Is this estimate likely to be too low, too high, or about right? Explain. $_{0.5pts}$

11) A group of 50,000 tax forms has an average gross income of $37,000, with an SD of $20,000. Furthermore, 20% of the forms have a gross income over $50,000. A group of 900 forms is chosen at random for audit. To estimate the chance that between 19% and 21% of the forms chosen for audit have gross incomes over $50,000, a box model is needed. $_{1.1pts}$

a. Should the number of tickets in the box be 900 or 50,000?

b. Each ticekt in the box shows "a zero or a one", or "a gross income"?

c. True or False: the SD of the box is $20,000.

d. True or False: the number of draws is 900.

e. Find the chance (approximately) that between 19% and 21% of the forms chosen for audit have gross incomes over $50,000.

f. With the information given, can you find the chance (approximately) that between 9% and 11% of the forms chosen for audit have gross incomes over $75,000? Either find the chance, or explain why you need more information.

12) As in the previous exercise, except it is desired to find the chance (approximately) that the

total gross income of the audited forms is $33,000,000. Work parts (a) through (d); then find the chance or explain why you need more information. $_{0.9pts}$

13) On the average, hotel guests who take elevators weigh about 150 pounds with an SD of about 35 pounds. An engineer is designing a large elevator for a convention hotel, to lift 50 such people. If she designs it to lift 4 tons, the chance it will be overloaded by a random group of 50 people is about _____. Explain. $_{0.5pts}$

14) The Census Bureau is planning to take a sample amounting to 1/10 of 1% of the population in each state in order to estimate the percentage of the population in that state earning over $100,000 a year. Other things being equal: $_{0.5pts}$

i. The accuracy to be expected in California (population 35 million) is about the same as the accuracy to be expected in Nevada (population 2 million).

ii. The accuracy to be expected in California is quite a bit higher than in Nevada.

iii. The accuracy to be expected in California is quite a bit lower than in Nevada.

Explain.