Lisa

Quiz 4
Sampling Distributions CH 11
Binomial Distributions CH 13

1. The average outstanding credit card balance for young couples is \$650 with a standard deviation of \$420.

   a. What is the probability that a couple chosen at random has a credit card balance exceeding \$700?

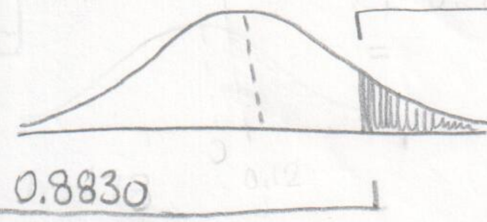
   Cannot answer because $n<30$ and the distribution of the population is unknown - cannot assume Normality.

   b. What is the probability that a random sample of 100 young couples have a mean credit card balance exceeding \$700?

   $P(\bar{X} > 700) = \boxed{0.117}$

   $Z = \dfrac{700-650}{420/\sqrt{100}} = 1.19$

   $1-0.8830$

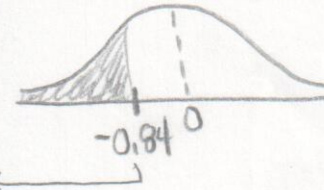


   c. What is the probability that a random sample of 200 young couples have a credit card balance totaling less than \$125,000?

   $n=200$ $\qquad P(\bar{X} < 625) = \boxed{0.2005}$

   $\bar{X} = \dfrac{125000}{200} = 625$

   $Z = \dfrac{625-650}{420/\sqrt{200}} = -0.84$



   d. The probability that 50 randomly chosen young couples have an average credit card balance greater than a certain average is 0.29. What is the average amount?

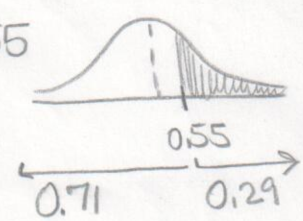
   $P(\bar{X} > k) = 0.29$ $\qquad P(\bar{X} < k) = 0.71$ $\qquad k = 0.55$

   $n=50$

   From reverse lookup $Z = 0.55$

   lookup 0.71

   $0.55 = \dfrac{\bar{X} - 650}{420/\sqrt{50}}$



   $\bar{X} = (0.55)(59.4) + 650$

   $\bar{X} = \boxed{682.67}$

   e. The probability that 50 randomly chosen young couples have an average credit card balance less than a certain average is 0.37. What is the average amount?

   $P(\bar{X} < k) = 0.37$ $\qquad -0.33 = \dfrac{\bar{X} - 650}{420/\sqrt{50}}$

   $n=50$

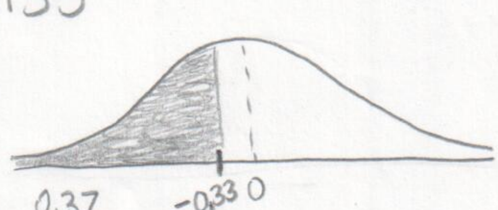
   From reverse lookup $\bar{X} = (-0.33)(59.4) + 650 = 630.4$

   $Z = -0.33$

   $P(\bar{X} < 630.4) = 0.37$

   $\boxed{\bar{X} = 630.4}$

   The avg amt is less than a certain amount. The prob. of that is



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2. An agent sells life insurance policies to five equally aged, healthy people. According to recent data, the probability of a person living for 30 years or more is 2/3.

   a. Define the random variable X to be the number of people living after 30 yrs.

   b. X has a binomial distribution with parameters $n=5$ $p=2/3=0.67$.

Calculate the probability that after 30 years…

   c. All five people are still living. $P(X=5)={}_5C_5\,(0.67)^5(0.33)^0$
   $=\boxed{0.135}$

   d. At least three people are still living. $P(X\geq 3)=P(X=3)+P(X=4)+P(X=5)$
   $P(X\geq 3)={}_5C_3\,(0.67)^3(0.33)^2+{}_5C_4\,(0.67)^4(0.33)^1+\underbrace{0.135}_{\text{found in c. above}}$
   $=(10)(0.3008)(0.1089)+(5)(0.2015)(0.33)+0.135$
   $=0.3276+0.3325+0.135=\boxed{0.7951}$

   e. At most two people are still living.
   $P(X\leq 2)=P(X=0)+P(X=1)+P(X=2)$
   OR $P(X\leq 2)=1-P(X\geq 3)=1-0.7951=\boxed{0.2049}$

3. A pharmaceutical lab states that a drug causes negative side effects in 3 of every 100 patients. If the lab chooses 100 patients at random, what is the mean and standard deviation of the distribution? Interpret these parameters in terms of the situation.
   $p=3/100=0.03$ $n=100$ $\mu=(100)(0.03)=3$
   $\sigma=\sqrt{np(1-p)}=1.706$
   In repeated sets of choosing 100 patients at random, on average 3 will experience negative side effects. Typically, the number of patients will vary by 1.7 or from 1 to 2 patients.

4. A bank found that 25% of its loans to new small businesses become delinquent. If 500 small businesses are selected randomly from the bank's files, what is the probability that at least 130 of them are delinquent? $\mu=np=125$
   $p=0.25$ $n=500$ $X=130$
   $\sigma=\sqrt{np(1-p)}=9.68$
   $np=125$ ✓
   $n(1-p)=375$ ✓
   $Z=\dfrac{130-125}{9.68}$ $Z=0.52$

   $P(X\geq 130)=1-P(X<130)$
   $=1-0.6985=\boxed{0.3014}$