Problems on normal random variables

Math 30530, Fall 2012

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Problems on normal random variables

- Adult marmots tend to have a weight that's normally distributed with mean 25 and standard deviation 5. What's the probability that a randomly chosen marmot weights over 32lbs?
- Measurement errors with a particular instrument are normally distributed with mean 0, variance .5.
  - What's the probability of a measurement error less than $\pm .35$?
  - 90% of all measurements have what $\pm$ error range?
- An article reports that 30% of 100 watt GE light bulbs run at at least 105 Watts, and that 10% run at at least 110 Watts. If wattage is normally distributed, what's the mean and variance?
- How likely is a normal random variable to be within
  - one standard deviation of its mean?
  - two standard deviations?
  - three standard deviations?

Problems on sums of normal random variables

- The amount of time I spend preparing for each lecture is normal with mean 80 and standard deviation 6. Different lectures are independent of each other. What is the probability that I spend more than 4.5 hours a week (3 lectures) preparing class?
- My score on a video game is normal with mean 100, variance 81. Your score in normal with mean 110, standard deviation 12. What's the probability that I beat you?

Problems on sums of non-normal random variables

- When I grade the final exam (53 students, 8 questions), the amount of time I spend grading each question follows the following distribution: 20% of the time, it's 1 minutes, 50% of the time it's 2 minutes, and 30% of the time it's 3 minutes. How likely is it that it will take me no more than 15 hours to grade all the exams?

- I estimate my total grocery bill by rounding each item's price to the nearest dollar. If I buy 48 items
  - How much error do I make in total?
  - If my total grocery bill is around \$200, what's the probability of a relative error of $\pm 5\%$

- People getting on an elevator have weight that is normal with $\mu = 180$, $\sigma = 20$. The capacity is 1500lbs. How many people can get in, and still be at least 99% sure that the elevator does not exceed capacity?

Problems on Binomial and Poisson approximation

- 48% of the population supports legalizing coffee. If I poll 1000 people at random, what is the probability that the percentage who support legalizing coffee is within $\pm$ 3% of 48%?
- The thickness of silicon wafers is normally distributed with mean 1mm, standard deviation .1mm. A wafer is acceptable if it has thickness between .85 and 1.1.
  - What is the probability that a wafer is acceptable?
  - If 200 wafers are selected, estimate the probability that between 140 and 160 wafers are acceptable.
- On average 25 cars per minute pass by a particular spot in the road. What (approximately) is the probability that more than 30 will pass by in the next minute?