

STAT220: WINTER 2008: QUIZ 3: March 6

Student name

Section

Please fill in your name and section. Answer the questions, on the question paper.

If you need more space, write on the back of THIS page.

It should take at most 20 minutes to complete this quiz.

Another page with a normal table, and some useful formulas is available: please keep it.

Show your work. You may assume the normal approximation is accurate for all the chances to be computed in this quiz.

Pete manages a small commercial apple orchard. In season, each week he loads his truck with 100 small crates of apples each containing approximately 20 lb of apples, for a total of 1 ton (2000 lb) of apples, to take to the Farmers' Market in the city.

Pete does not want to be short on weight, but he also does not want to overload his old truck. In fact, the actual weight of apples packed in each crate has an average of 20.1 lb and a standard deviation (SD) of 1 lb. **Added info: The histogram of the weights has the Normal shape.**

1. (3 points) **Show** that the overall percentage of crates that contain less than 20 lb of apples is 46%.

$$\begin{aligned} z\text{-score} &= (20 - 20.1)/1 = -0.1 \text{ (1 point)} & \text{middle area} &= 8\% \text{ (1 point)} \\ \text{required area is left end, which is } & (100-8)/2 = 46\% \text{ (1 point)} \end{aligned}$$

2. (a) (2 points) On a particular week, what is the expected value (EV) of the number of Pete's 100 crates that contain less than 20 lb of apples.

The model is a 0/1 "box" with 46% 1 and 54% 0.

$$\begin{aligned} \text{EV}(\text{count}) &= (\text{number of draws}) \times (\text{fraction of 1's}) \text{ (1 point)} \\ &= 100 \times 0.46 = 46 \text{ (1 point)} \end{aligned}$$

(b) (2 points) On a particular week, what is the standard error (SE) of the number of Pete's 100 crates that contain less than 20 lb of apples.

$$\begin{aligned} \text{SE}(\text{count}) &= \sqrt{\text{number of draws} \times (\text{SD box for a 0/1 box})} \text{ (1 point)} \\ &= 10 \times \sqrt{0.46 \times 0.54} \approx 5. \text{ (1 point)} \end{aligned}$$

(c) (3 points) On a particular week, what is the chance that at least 50 of Pete's 100 crates contain less than 20 lb of apples.

$$\begin{aligned} z\text{-score} &= (50 - 46)/5 = 0.8 \text{ (1 point)} & \text{middle area} &= 58\% \text{ (1 point)} \\ \text{required area is right-hand end, or } & (100-58)/2 = 21\% \text{ (1 point)} \end{aligned}$$

3 (a) (1 point) On a particular week, what is the expected value (EV) of the average weight of apples per crate in Pete's 100 crates.

$$\text{EV}(\text{average}) = (\text{box average}) = 20.1 \text{ lb (1 point)}$$

(b) (2 points) On a particular week, what is the standard error (SE) of the average weight of apples per crate in Pete's 100 crates.

$$\text{SE}(\text{average}) = (\text{SD box})/\sqrt{\text{number of draws}} = 1/10 = 0.1 \text{ lb (2 points)}$$

(c) (3 points) On a particular week, what is the chance that the average weight of apples per crate in Pete's 100 crates is less than 20 lb.

$$\begin{aligned} z\text{-score} &= (20 - 20.1)/0.1 = -1 \text{ (1 point)} & \text{middle-area} &= 68\% \text{ (1 point)} \\ \text{required area is left-hand end, which is } & (100-68)/2 = 16\% \text{ (1 point)}. \end{aligned}$$