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question @34 stop following 12 views

Actions

4.23

Has anyone figured out a solution to Chapter 4 #23 on page 174?

hw4

Edit undo good question | 2 Updated 5 years ago by Sophie Hecht

S **the students' answer,** *where students collectively construct a single answer*

Actions

Here is a solution I found online: https://www.coursehero.com/file/p2fcrqko/Whether-you-want-to-use-the-continuity-correction-is-up-to-you-Solution-Let-X

Edit - The website is a bit funky, it may be easier if I screenshot the solution:

4.2 Suppose that the distribution of the lifetime of a car battery, produced by a certain car company, is well approximated by a normal distribution with a mean of 1 .2 × 10^3 hours and varance 10^4. What is the approximate probability that a batch of 100 car batteries will contain at least 20 whose lifetimes are less than 1 , 100 hours?

Solution. Let X be the lifetime of a single car battery. Then, letting $Z \sim N(0, 1)$ we have

$$P(X \le 1,100) = P(1,200 + 10^2 Z \le 1,100)$$
$$= P(Z \le -1) = 1 - \Phi(1) = 1 - 0.8413 = 0.1587.$$

Now let W be the number of car batteries, in a batch of 100, whose lifetimes are less than 1,100 hours. Note that $W \sim \text{Binomial}(100, 0.1587)$. Using a normal approximation, we have

$$P(W \ge 20) = P\left(\frac{W - 100 \cdot 0.1587}{\sqrt{100 \cdot 0.1587 \cdot 0.8413}} \ge \frac{20 - 100 \cdot 0.1587}{\sqrt{100 \cdot 0.1587 \cdot 0.8413}}\right) \approx P(Z \ge 1.13)$$
$$= 1 - \Phi(1.13) = 1 - 0.8708$$
$$= 0.1292.$$

Edit 2 - The first part is $normalcdf(0, 1100, 1200, \sqrt{10^4})$. I'm not entirely sure what the second part is because of the formatting, although it appears to be something like $P(W \geq 20) = P(\frac{W-np}{\sqrt{np(1-p)}} \geq \frac{20-np}{\sqrt{np(1-p)}})$ which seems like a complicated form of the binomial distribution.

Edit thanks! | 1 Updated 5 years ago by Charles Hwang

i **the instructors' answer,** *where instructors collectively construct a single answer*

You are given $X \sim N(1200, 100)$ and you are asked to find the probability that in 100 batteries at least 20 have a lifetime less that 1100 hours. This looks like Binomial with $n = 100$ and $p = P(X < 1100)$. You have to find p first.

$p = P(X < 1100) = normalcdf(-\infty, 1100, 1200, 100) = 0.1586$
Then if Y is the number of successes in 100 trials we have

$P(Y \geq 20) = 1 - P(Y \leq 19) = 1 - binomcdf(100, 0.1586, 19) = 0.159$

If we use the normal approximation with continuity correction to Y we get $Y \sim N(15.86, \sqrt{100(0.1586).8414})$ and so

$P(Y \geq 20) = normalcdf(19.5, 999999, 15.86, 3.65) = 0.1593$ which is pretty close to the exact solution.

undo thanks | 1

Updated 5 years ago by E.N. Barron

followup discussions *for lingering questions and comments*

Resolved Unresolved @34_f1

E.N. Barron 5 years ago
I'll answer tomorrow afternoon if no one posts the solution by 1.

good comment | 0

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