MATH 120: Quiz 8 - 4/11/2019

Assume human pregnancy durations have a slightly skewed distribution with a mean of 265 days and standard deviation of 16 days. An obstetrician is currently providing care to a group of 52 pregnant women. Let $\bar{y}$ represent the mean duration of their pregnancies.
(a) Are the conditions for applying the Central Limit Theorem to the sampling distribution of $\bar{y}$ satisfied?
(b) Assume they are satisfied [regardless of the correct answer to (a)], and find the probability that these 52 women will have a mean pregnancy duration less than 260 days.

[*As always, show steps/reasons and relevant sketches.*]

Solution

In this problem, the population parameters are: $\mu = 265$ and $\sigma = 16$ days.
The sample size is: $n = 52$.

(a) Checking the conditions for applying the Central Limit Theorem:

(i) Is the sample independent?

Is it random: Hmm... That isn't clear. We only know the sample is a group of pregnant women under the care of the obstetrician.

Is $n < 10\%$: Yes, if we assume the population is all pregnant women (in some region), 52 women should be less than 10%.

It is not clear if the sample is independent. Interpret any results with caution.

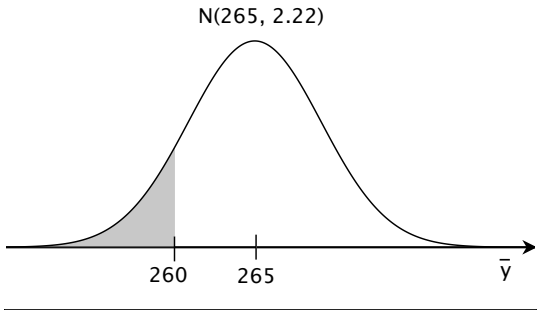
(ii) Large enough sample?

Yes, $n = 52$ is likely large enough, since the population is only slightly skewed.

All conditions may not be satisfied. Use the Central Limit Theorem with caution.

(b) According to the CLT, sampling distribution follows the normal model $N(265, \frac{16}{\sqrt{52}})$ days.
In this problem, we want sample mean: $\bar{y} < 260$.

The sketch shows the model, and the area we want to find.



Compute z-score: $z = \dfrac{260 - 265}{2.22} = -2.25$

From the standard normal tables, the area for $z < -2.25$ is 0.0122.

Answer: There is a 0.0122 probability that this sample of 52 women will have a mean pregnancy duration less than 260 days. NOTE, however, that this conclusion is questionable, as it is based on a sample that may not have fully met the CLT conditions.

Grading: Total points possible = 6.

2.5 pt for (a): 0.5pt = identify μ, σ and n correctly.
1pt each for correctly checking each of 2 conditions.

3.5 pt for (b): 1pt = correct normal model, with the right mean and SD.
0.5pt = sketch of model, showing what is to be computed.
1pt = compute correct z-score.
1pt = look up normal table correctly and get the required area.