§ 8.4 Point Estimation

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1. The error of our estimate (i.e. the distance between our estimate & the actual population parameter) is not likely to exceed this margin (value).

2. unbiased
small variance

3. (a) Margin of error = 1.96 (S.E.)

$$= 1.96\left(\frac{\sigma}{\sqrt{n}}\right) = 1.96\left(\frac{\sqrt{\sigma^2}}{\sqrt{n}}\right) = 1.96\sqrt{\frac{\sigma^2}{n}}$$

$$= 1.96\left(\sqrt{\frac{.2}{30}}\right) \approx \boxed{.1600}$$

(b) Margin of error $= 1.96\sqrt{\frac{.9}{30}} \approx \boxed{.3395}$

(c) M.O.E. $= 1.96\sqrt{\frac{1.5}{30}} \approx \boxed{.4383}$

4. Larger variance $\Rightarrow$ larger margin of error.

5. (a) $1.96\sqrt{\frac{4}{50}} \approx \boxed{.5544}$

(b) $1.96\sqrt{\frac{4}{500}} \approx \boxed{.1753}$

(c) $1.96\sqrt{\frac{4}{5000}} \approx \boxed{.0554}$

6. INCREASED SAMPLE SIZE $\Rightarrow$ DECREASED MARGIN OF ERROR.

7. MARGIN OF ERROR $= 1.96(S.E.) = 1.96\sqrt{\frac{pq}{n}}$

$= 1.96\sqrt{\frac{(.5)(.5)}{30}} \approx \boxed{.1789}$

(b) $1.96\sqrt{\frac{(.5)(.5)}{100}} = \boxed{.098}$

(c) $1.96\sqrt{\frac{(.5)(.5)}{400}} = \boxed{.049}$

(d) $1.96\sqrt{\frac{(.5)(.5)}{1000}} \approx \boxed{.0310}$

8. LARGER SAMPLE SIZE $\Rightarrow$ SMALLER MARGIN OF ERROR.

9. (a) $1.96\sqrt{\frac{(.1)(.9)}{100}} = \boxed{.0588}$

(b) $1.96\sqrt{\frac{(.3)(.7)}{100}} \approx \boxed{.0898}$

(c) $1.96\sqrt{\frac{(.5)(.5)}{100}} = \boxed{.098}$

(d) SAME AS (b)

(e) SAME AS (a)

(f) $\boxed{p = .5}$

10. $p = .5$ SINCE YOU WOULD PRESUMABLY WANT TO USE THE LARGEST MARGIN OF ERROR.

11. $p \approx \hat{p} = \frac{655}{900} \approx \boxed{.7278}$

MARGIN OF ERROR $= 1.96\,(S.E.) \approx 1.96\sqrt{\frac{\hat{p}\hat{q}}{n}} = 1.96\sqrt{\frac{(.7278)(.2722)}{900}}$

$\approx \boxed{.0291}$

12. $\mu \approx \bar{x} = 56.4$

MARGIN OF ERROR $= 1.96\,(S.E.) \approx 1.96\sqrt{\frac{s^2}{n}} = 1.96\sqrt{\frac{2.6}{50}} \approx \boxed{.4469}$

13. $p \approx \hat{p} = \frac{x}{n} = \frac{450}{500} = \boxed{.9}$

MARGIN OF ERROR $= 1.96\sqrt{\frac{pq}{n}} \approx 1.96\sqrt{\frac{\hat{p}\hat{q}}{n}} = 1.96\sqrt{\frac{(.9)(.1)}{500}} \approx \boxed{.0263}$

14. $\mu \approx \bar{x} = \boxed{29.7}$

MARGIN OF ERROR $= 1.96\,(S.E.) = 1.96\sqrt{\frac{\sigma^2}{n}} \approx 1.96\sqrt{\frac{s^2}{n}}$

$= 1.96\sqrt{\frac{10.8}{75}} \approx \boxed{.7438}$

15. MEAN ANGULAR DIRECTION $\approx \bar{x} = \boxed{39.8^\circ}$

MARGIN OF ERROR $\approx 1.96\,\frac{s}{\sqrt{n}} = 1.96 \cdot \frac{17.2}{\sqrt{50}} \approx \boxed{4.7676^\circ}$

16. $\mu \approx \bar{x} = \boxed{4.2 \text{ kg/m}^2}$

MARGIN OF ERROR $\approx 1.96 \cdot \frac{1.5}{\sqrt{75}} \approx \boxed{.3395 \text{ kg/m}^2}$

17. $\mu \approx \bar{x} = \boxed{7.2\%}$ (FOR THIS QUESTION, WE USE % AS A UNIT.)

MARGIN OF ERROR $\approx 1.96 \cdot \frac{s}{\sqrt{n}} = 1.96 \cdot \frac{5.6}{\sqrt{200}} \approx \boxed{.7761\%}$

18. (a) $p \approx \hat{p} = \frac{x}{n} = \frac{170}{250} = \boxed{.68}$

MARGIN OF ERROR $\approx 1.96\sqrt{\frac{\hat{p}\hat{q}}{n}} = 1.96\sqrt{\frac{(.68)(.32)}{250}}$

$\approx \boxed{.0578}$

(b) $p \approx \hat{p} = \frac{x}{n} = \frac{120}{250} = \boxed{.48}$

MARGIN OF ERROR $\approx 1.96\sqrt{\frac{\hat{p}\hat{q}}{n}} = 1.96\sqrt{\frac{(.48)(.52)}{250}}$

$\approx \boxed{.0619}$

19. (a) $p \approx \hat{p} = \boxed{.75}$

MARGIN OF ERROR $= 1.96\sqrt{\frac{(.75)(.25)}{1004}} \approx \boxed{.0268}$

(b) SHOULD USE $p = .5$ (TO PRODUCE LARGEST MARGIN OF ERROR)

$\left(1.96\sqrt{\frac{(.5)(.5)}{1004}} \approx .0309 \neq 3.5. \text{ SO, NO.}\right)$

20. (a) 3 DIFFERENT POPULATIONS:

BILLING STATEMENTS FROM 3 DIFFERENT HOTEL CHAINS.

NIGHTLY ROOM RATES

(b) $\mu \approx 150$

MARGIN OF ERROR $= 1.96\left(\frac{17.2}{\sqrt{50}}\right) \approx 4.77$

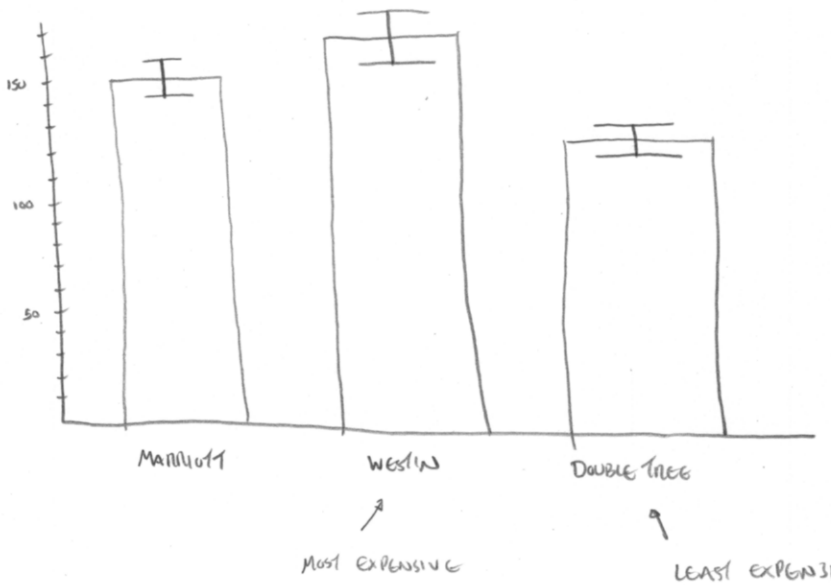
(c) $\mu \approx 165$

MARGIN OF ERROR $= 1.96\left(\frac{22.5}{\sqrt{50}}\right) \approx 6.24$

(d) $\mu \approx 125$

MARGIN OF ERROR $= 1.96\left(\frac{12.8}{\sqrt{50}}\right) \approx 3.55$

(e)



21. (a) No. RESPONSE BIAS (AND MORE)

(b) NOTHING. NO.

22. (a) $p \approx \hat{p} = .49$

MARGIN OF ERROR $\approx 1.96\sqrt{\frac{(.49)(.51)}{1034}} \approx .0305$

(b) use $\hat{p} = .5$

↳ $1.96\sqrt{\frac{(.5)(.5)}{1034}} \approx .0305$

23. $\mu \approx \bar{x} =$ 19.3 MINUTES

MARGIN OF ERROR $\approx 1.96\left(\frac{s}{\sqrt{n}}\right) = 1.96\left(\frac{5.2}{\sqrt{30}}\right) \approx$ 1.8608 MINUTES