

A/B Testing

1. True or False

- 1.1. True
- 1.2. True
- 1.3. False
- 1.4. False
- 1.5. False
- 1.6. True
- 1.7. False
- 1.8. False
- 1.9. True
- 1.10. False

2. Page views or unique visitors

- 1.11. Page views
- 1.12. Unique visitors
- 1.13. Unique visitors
- 1.14. Unique visitors

3. Conversion rate

- 1.15. $\frac{\text{purchases in 2020-11}}{\text{unique users in 2020-11}} = \frac{1}{4}$
- 1.16. $\frac{\text{purchases}}{\text{unique users in 2020-11}} = \frac{2}{4}$

9. From 80:20 ration, so $m = \frac{80}{20} = 4$. And $MDE = 0.01$

Since the average conversion rate is 0.11, then the variance is $(0.11)(1-0.11) = 0.0979$

From significance level = 0.15, so $Z_\alpha = 1.036 = \frac{x - \mu}{\sigma} = \frac{x - 0.11}{\sqrt{0.0979}}$

We get $x = 0.434$

Use x to find $Z_\beta = \frac{x - \mu}{\sigma} = \frac{0.434 - 0.12}{\sqrt{0.0979}} = 0.966$

$$\begin{aligned} n &= \frac{m+1}{m} \left(\frac{(Z_\alpha + Z_\beta)\sigma}{MDE} \right)^2 \\ &= \frac{5}{4} \left(\frac{(Z_\alpha + Z_\beta)\sqrt{0.0979}}{0.01} \right)^2 \\ &= \frac{5}{4} \left(\frac{(1.036 + 0.966)\sqrt{0.0979}}{0.01} \right)^2 \\ n &\approx 4904.79 \end{aligned}$$

That's mean we need at least 4904.79 or 4905 people for gold package and 19620 people for red package.

10. $H_0 : \mu_{red} = \mu_{gold}$

$$H_a : \mu_{red} < \mu_{gold}$$

$$\sigma_{red}^2 = (0.099170)(1 - 0.099170) = 0.0893$$

$$\sigma_{gold}^2 = (0.101995)(1 - 0.101995) = 0.0916$$

$$Z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} = \frac{(0.101995 - 0.099170) - 0}{\sqrt{\frac{0.0893}{59504} + \frac{0.0916}{58944}}} = 1.616$$

We get that $p - value \approx 0.05$

10.1 since $0.05 < 0.07$, so we reject H_0 and choose “Gold campaign.”

10.2 confidence interval = sample proportion \pm margin of error

$$\text{margin of error} = Z \times \sqrt{\frac{(\text{sample proportion})(1 - \text{sample proportion})}{\text{sample size}}}$$

With significance level = 0.07 and two-sided, $Z = 1.812$

Red campaign

$$CI_{red} = 0.099170 \pm 1.812 \sqrt{\frac{0.099170 \cdot (1 - 0.099170)}{59504}}$$

$$CI_{red} = 0.099170 \pm 0.002220$$

$$CI_{red, left} = 0.09695, CI_{red, right} = 0.10139$$

Gold campaign

$$CI_{gold} = 0.101995 \pm 1.812 \sqrt{\frac{0.101995 \cdot (1 - 0.101995)}{58944}}$$

$$CI_{gold} = 0.101995 \pm 0.002259$$

$$CI_{gold, left} = 0.099736, CI_{gold, right} = 0.104254$$