CIMT Further Stats p47 Example.

X = no. shareholders in favour of offer

$X \sim B(400, p)$

$H_0: p = 0.5$

$H_1: p > 0.5$

Assume H_0 to be true. $\alpha = 1\%$. 1 tail test

METHOD 1

test statistic, $x_c = 219$

p-value $= P(X \geq 219)$

$= 0.032089$ by binomcdf(400, 0.5, 219, 400)

> 0.01

CONCLUSION

Hence, based on this sample, we are not in most extreme 1%, and hence we don't have evidence to reject H_0, and thus Chairman of Company B's claim that shareholders are equally divided seems to be valid.

METHOD 2

test statistic, $x_c = 219$

$X \sim B(400, 0.5)$

Approximate with Normal as $np > 5$ and $nq > 5$

let Y be approximation for X

$Y \sim N(200, 10^2)$

so $P(X \geq 219) \approx P(Y \geq 218.5)$ by c.c.

$= P\left(Z \geq \frac{218.5 - 200}{10}\right)$

$= P(Z \geq 1.85)$

$= 0.032157$ by normCdf(1.85, 9E99)

> 0.01

CIMT p47 example, continued

test statistic, sample proportion $= \frac{219}{400}$

$X \sim B(400, 0.5)$

Approximate with normal as $np > 5$ and $nq > 5$

let Y be normal approximation for X

So $Y \sim N(200, 10^2)$

Y is still "number of shareholders in favour"

define new random variable, $\frac{Y}{400}$ = proportion of shareholders in favour.

METHOD 3.

So $\frac{Y}{400} \sim N\left(\frac{200}{400}, \frac{10^2}{400^2}\right)$ (1)

as $E\left(\frac{Y}{400}\right) = \frac{1}{400}E(Y) = \frac{1}{400} \times 200$

$Var\left(\frac{Y}{400}\right) = \frac{1}{400^2}Var(Y) = \frac{1}{400^2} \times 10^2$

$\frac{Y}{400} \sim N(0.5, 0.025^2)$

So p-value $= P\left(\frac{Y}{400} \geq \frac{219}{400}\right)$

$= P\left(Z \geq \frac{\frac{219}{400} - 0.5}{0.025}\right)$

$= P(Z \geq 1.9)$

$= 0.028716$

> 0.01

METHOD 4

same as Method 3, but we include continuity correction...

p-value $= P\left(\frac{Y}{400} \geq \frac{218.5}{400}\right)$

$= P\left(Z \geq \frac{\frac{218.5}{400} - 0.5}{0.025}\right)$

$= P(Z \geq 1.85)$

$= 0.032157$

> 0.01 which now matches METHOD 2.