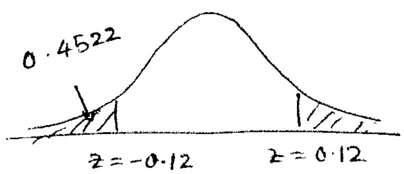
1) The null hypothesis always contains an equality and takes the value at which the claim is marginally false.

Therefore (B)

2) The smaller the p-value, the stronger the evidence against H_0.
So if the p-value is to be in consistent with H_0, p-value has to **be** large

Therefore (D)

3) Since $H_a: p \neq p_0$, this is a two tail probability.



therefore $P\text{-value} = 2\,(0.4522)$

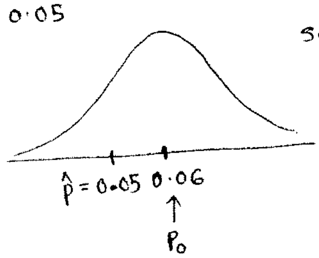
$= 0.9044$

$= 0.90.$

4) $H_0: p = 0.06$ $\quad n = 100$

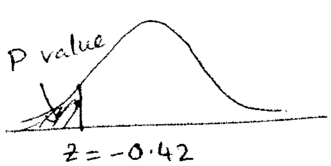
$H_a: p < 0.05$

$$se = \sqrt{\frac{p_0(1-p_0)}{n}} = \sqrt{\frac{0.06\,(1-0.06)}{100}} = 0.0237.$$



$$z = \frac{\hat{p} - p_0}{se} = \frac{0.05 - 0.06}{0.0237} = -0.42$$

implies this is a left tail probability.



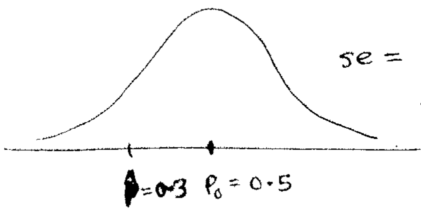
P value $= 0.3372$

$= 0.34.$

5)

5) $H_0 : p = 0.5$ $n = 1933$

$\hat{p} = 0.3$



$$se = \sqrt{\frac{p_0(1-p_0)}{n}} = \sqrt{\frac{0.5(0.5)}{1933}} = 0.0114$$

$$z = \frac{\hat{p} - p_0}{se} = \frac{0.3 - 0.5}{0.0114} = -17.54.$$

6) $P < \alpha$

$0.0485 < 0.05$

Therefore reject H_0. (Accept H_a)

(E)

7) $H_0 : p = 0.4$ P-value $= 0.005$ ← very small.
$H_a : p > 0.4$

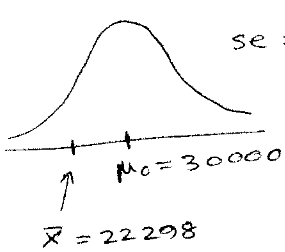
P-value is the probability that ~~we~~ can observe ~~the~~ observed value or values more extreme if H_0 is true.

Therefore, if H_0 is true, that is if the chlorine level has not changed, the probability of observing the sample chlorine level observed or more, higher values is 0.005. Therefore since P value is very less, reject H_0.

Therefore we conclude that the chlorine level has increased,

(C)

8) $H_0 : \mu = 30000$ $n = 17$ $\bar{x} = 22298$ $s = 14200$



$$se = \frac{s}{\sqrt{n}} = \frac{14200}{\sqrt{17}} = 3444$$

$$t = \frac{\bar{x} - \mu_0}{se} = \frac{22298 - 30000}{3444} = -2.24$$

9) $H_a : \mu \neq 12$. therefore, this is a two tail probability.

Take $|t| = |-2.5| = 2.5$,

$df = 15 - 1 = 14$.

df	$t_{0.025}$	$t_{0.010}$
14	2.145	2.624

$$2.145 < 2.5 < 2.624$$

Since ~~two~~ tail P-value falls between

$$2(0.010) < P < 2(0.025)$$

$$0.02 < P < 0.05$$

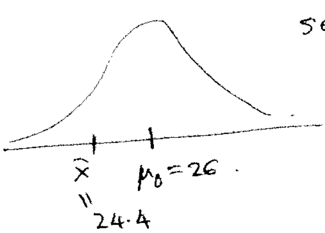
(P-value cannot be 0.05 since for that t has to be 2.624)

Therefore P-value = 0.025

10) $H_0 : \mu = 26$ $\quad H_a : \mu < 26$ $\quad n = 25$ $\quad \bar{x} = 24.4$ $\quad s = 9.2$

(Since we are dealing with a mean and the sample size is small, we have to use t-score.

$$se = \frac{s}{\sqrt{n}} = \frac{9.2}{\sqrt{25}} = 1.84$$



$$t = \frac{\bar{x} - \mu_0}{se} = \frac{24.4 - 26}{1.84} = -0.87$$

There is only one answer with $t = -0.87$. Therefore (C).

(If there were two answers with $t = -0.87$, then we have to find the P-value to decide whether to reject or not reject H_0).

11) $H_0 : \mu = 46$
$H_a : \mu \neq 46$

Therefore two tail.

12) $H_0 : \mu = 500$
$H_a : \mu > 500$

right tail

13) Type I error is when we reject a true H_0.
Therefore if we conclude $\mu > 9.8$ (accepting H_a means rejecting H_0), while in fo
$\mu = 9.8$, it is a type I error.

(B)

14) Failing to reject a false null hypothesis is Type II error.
The test failed to reject H_0. However, $\mu \neq 9.4$. (That is H_0 is false).

Therefore Type II error.