

Stat 312: Lecture 12

Testing on Population Proportion

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Concepts

1. Testing mean μ when the sample size is large.

$$H_0 : \mu = \mu_0 \text{ vs. } H_1 : \mu < \mu_0$$

Test statistic: $z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$. Rejection region for level α test: $z \leq -z_\alpha$.

2. Let p be the proportion of a population with a specified property. Large-sample level α test for

$$H_0 : p = p_0 \text{ vs. } H_1 : p < p_0$$

test statistic: $z = \frac{\hat{p} - p_0}{\sqrt{p_0(1-p_0)/n}}$.

rejection region: $z < -z_\alpha$.

3. The P -value is the smallest level of significance at which H_0 would be rejected.

$P\text{-value} \leq \alpha \rightarrow$ reject H_0 at level α .

$P\text{-value} > \alpha \rightarrow$ do not reject H_0 at level α .

The smaller the P -value, the easier to reject H_0 .

```
> t=(mean(x)-100)/(sd(x)/sqrt(10))
```

```
> t
```

```
[1] -4.205156
```

```
> qt(c(0.001,0.002,0.003),9)
```

```
[1] -4.296806 -3.834510 -3.572577
```

```
> pt(-4.205156,9)
```

```
[1] 0.001144577
```

```
> t.test(x,mu=100,alternative="less",
conf.level=0.95)
```

```
One Sample t-test
```

```
data: x t = -4.2036, df = 9,
```

```
p-value = 0.001147
```

```
alternative hypothesis: true mean is
less than 100
```

```
95 percent confidence interval:
```

```
-Inf 78.8531
```

```
sample estimates: mean of x 62.5
```

Three options for `alternative`: `less`, `greater`, `two.sided`.

Find the P -value for testing

$$H_0 : \mu = 100 \text{ vs. } H_1 : \mu \neq 100$$

In-class problems

Example 8.11. 47 out of 102 doctors did not know the generic name for the drug methadone. Can you conclude that fewer than half of all doctors know the generic name for methadone? Test it at 1% level.

```
> p<-47/102
```

```
> (p-0.5)/sqrt(0.5*0.5/102)
```

```
[1] -0.792118
```

```
> qnorm(0.01)
```

```
[1] -2.326348
```

Assume the IQ of a dog follows normal. The IQs of 10 dogs are measured: 30, 25, 70, 110, 40, 80, 50, 60, 100, 60. Find the P -value for testing

$$H_0 : \mu = 100 \text{ vs. } H_1 : \mu < 100$$

Self-study problems

Exercise 8.35., Example 8.17., Find the P -value for testing

$$H_0 : \mu = 100 \text{ vs. } H_1 : \mu > 100$$

Assignment 4.

Due March 13. 11:00am. 8.24., 8.26, 8.28., 8.36. (a) and (b) only, 8.38.