Critical Region

- We reject H_0 when the observed value of the test statistic is in the critical region.

Make sure you are familiar with the method of critical region!!!

Critical Region

- When the significance level is $\alpha = 0.05$, the critical region can be

	$N(0,1)$	t_n
2-sided	$(-\infty, -1.96) \cup (1.96, +\infty)$	$(-\infty, -t_{n,0.025}) \cup (t_{n,0.025}, +\infty)$
L-sided	$(-\infty, -1.65)$	$(-\infty, -t_{n,0.05})$
R-sided	$(1.65, +\infty)$	$(t_{n,0.05}, +\infty)$

  where $t_{n,0.025}$ is the critical value corresponding to the column of $P = 2.5\%$ in the t distribution table, $t_{n,0.05}$ corresponds to the column of $P = 5\%$.

- To find the value of $t_{n,0.025}$, we use R:

$$t_{n,0.025} = -\text{qt}(0.025,\ \text{df})$$

$$t_{n,0.05} = -\text{qt}(0.05,\ \text{df})$$

Critical Region

- When the significance level α is arbitrary, the critical region can be

	$Z \sim N(0,1)$	$T \sim t_n$
2-sided	$(-\infty, -z_{\alpha/2}) \cup (z_{\alpha/2}, +\infty)$	$(-\infty, -t_{n,\alpha/2}) \cup (t_{n,\alpha/2}, +\infty)$
L-sided	$(-\infty, -z_{\alpha})$	$(-\infty, -t_{n,\alpha})$
R-sided	$(z_{\alpha}, +\infty)$	$(t_{n,\alpha}, +\infty)$

  where z_α is a value such that $P(Z \leqslant z_\alpha) = 1 - \alpha$, $t_{n,\alpha}$ is a value such that $P(T \leqslant t_{n,\alpha}) = 1 - \alpha$.

- To find the value of z_α, we use R:

$$z_\alpha = -\text{qnorm}(\alpha)$$

- To find the value of $t_{n,\alpha}$, we use R:

$$t_{n,\alpha} = -\text{qt}(\alpha, \text{df})$$

p-value

- When the p-value is less than the significant level α, we reject H_0.
- Suppose that the observed value of the test statistic is δ, the p-value:

	$Z \sim N(0,1)$	$T \sim t_n$
2-sided	$P(Z < -\|\delta\|) + P(Z > \|\delta\|)$	$P(T < -\|\delta\|) + P(T > \|\delta\|)$
L-sided	$P(Z < \delta)$	$P(T < \delta)$
R-sided	$P(Z > \delta)$	$P(T > \delta)$

We can use R to calculate the above p-value:

	$N(0,1)$	t_n
2-sided	2*pnorm($-\|\delta\|$)	2*pt($-\|\delta\|$,df)
L-sided	pnorm($-\delta$)	pt($-\delta$,df)
R-sided	1−pnorm(δ)	1−pt(δ,df)

Critical Region

You must be familiar with the method of critical region when performing the hypothesis testing. In your exam, it is hard to find p-values.