SOLUTIONS: TWO-SAMPLE HYPOTHESIS TESTING
TWO-SAMPLE Z-TESTS

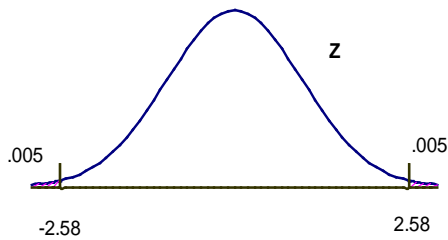PROBLEM 1:
Typing Speed on a pc. Who types faster, Men or Women?

	Men	Women
$\overline{X}$	65 wpm	68 wpm
s	10 wpm	14 wpm
n	50	60

Test at α = .01.

$$H_0 : \mu_1 = \mu_2$$
$$H_1 : \mu_1 \neq \mu_2$$

.005   .005

-2.58   2.58

$$Z = \frac{65 - 68}{\sqrt{\frac{(10)^2}{50} + \frac{(14)^2}{60}}} = \frac{-3}{2.29} = -1.30 \qquad \text{DO NOT REJECT } H_0$$

PROBLEM 2:
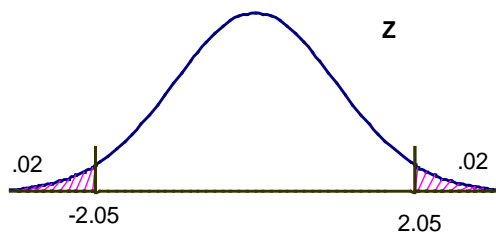Take-Home Pay. Who earns more: Married or unmarried people?

	Married	Not Married
$\overline{X}$	$639.60	$658.20
s	$60	$90
n	40	60

Test at $\alpha = .04$

$$H_0 : \mu_1 = \mu_2$$
$$H_1 : \mu_1 \neq \mu_2$$

.02   Z   .02
-2.05   2.05

$$Z = \frac{-18.60}{\sqrt{\frac{(60)^2}{40} + \frac{(90)^2}{60}}} = \frac{-18.60}{\sqrt{225}} = \frac{-18.60}{15} = -1.24$$
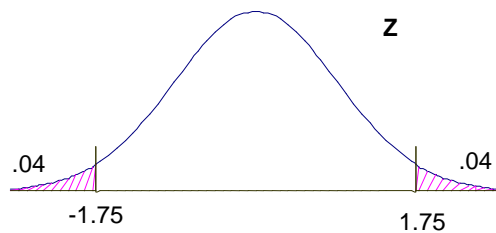
DO NOT REJECT H_0.

PROBLEM 3:
Are the machine tools manufactured by Company X and Y different with regard to how long they last?

	Company X	Company Y
$\overline{X}$	16.2 weeks	15.9 weeks
s	.2 weeks	.2 weeks
n	40	40

Test at α = .08

$H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 \neq \mu_2$

.04   **Z**   .04

-1.75   1.75

$$Z = \frac{16.2 - 15.9}{\sqrt{\dfrac{(.2)^2}{40} + \dfrac{(.2)^2}{40}}} = \frac{.3}{\sqrt{.002}} = \frac{.3}{.045} = 6.71 \qquad \text{REJECT } H_0$$

PROBLEM 4:
Who lives longer, married or unmarried women? Test at $\alpha = .01$

Single women   Married Women
$\overline{X}_1 = 78.5\,years$ $\overline{X}_2 = 77.0\,years$
$S_1 = 14.0\,years$ $S_2 = 16.0\,years$
$n_1 = 140$ $n_2 = 160$

$H_0 : \mu_1 = \mu_2$
$H_1 : \mu_1 \neq \mu_2$
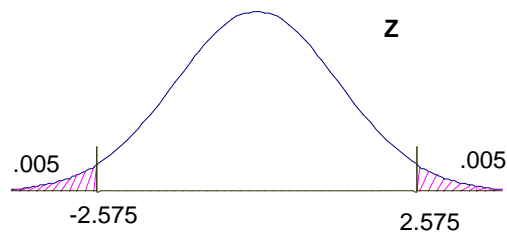
$$Z = \frac{1.5}{\sqrt{\dfrac{(14)^2}{140} + \dfrac{(16)^2}{160}}} = \frac{1.5}{\sqrt{3}} = \frac{1.5}{1.73} = 0.86$$

DO NOT REJECT H_0.

PROBLEM 5:

Who misses work more often at the ABC Company: Smokers or non-smokers? Test at .05 significance level.

Smokers: Average number of days absent = 14.7;   standard deviation = 5.0;   n = 44
Non-Smokers: Average number of days absent = 8.3;   standard deviation = 4.0;   n = 60

$$Z = \frac{6.4}{\sqrt{\dfrac{(5)^2}{44} + \dfrac{(4)^2}{60}}} = \frac{6.4}{\sqrt{.834}} = \frac{6.4}{.914} = 7.00$$

The critical value of Z – two-tail test at .05 significance level is plus and minus 1.96
Reject Ho: 7.00 is greater than 1.96 so we are in the rejection region.
The difference of 6.4 days is statistically significant.

PROBLEM 6:

Who has the higher hourly wage at the ABC Company: Men or Women? Test at .05 significance level.

Men: Average hourly wage = $12.50;   standard deviation = $1.60;   n = 80
Women: Average hourly wage = $11.40;   standard deviation = $3.20;   n = 120

$$Z = \frac{1.10}{\sqrt{\dfrac{(1.60)^2}{80} + \dfrac{(3.20)^2}{120}}} = \frac{1.10}{\sqrt{.117}} = \frac{1.10}{.342} = 3.22$$

The critical value of Z – two-tail test at .05 significance level is plus and minus 1.96

Reject Ho: The difference of $1.10 is statistically significant.

PROBLEM 7:

Who has a longer life span? Test at .05 significance level.

Non-drug user: Average life span = 82.5 years; standard deviation = 12 years;   n = 120
Drug user: Average life span = 72.5 years; standard deviation = 12.5 years; n = 50

$$Z = \frac{10}{\sqrt{\frac{(12)^2}{120} + \frac{(12.5)^2}{50}}} = \frac{10}{\sqrt{4.325}} = 4.81$$

The critical value of Z – two-tail test at .05 significance level is plus and minus 1.96

Reject Ho: The difference of 10 years is statistically significant.

PROBLEM 8:

Who earns more? Test at .01 significance level.

High school graduates: Average salary = $35,000; standard deviation = $15,000; n = 150
High school dropouts: Average salary = $26,000; standard deviation = $10,000; n = 100

$$Z = \frac{9000}{\sqrt{\frac{(15000)^2}{150} + \frac{(10000)^2}{100}}} = \frac{9000}{1581.1} = 5.69$$

The critical value of Z – two-tail test at .01 significance level is plus and minus 2.575

Reject Ho: The difference of $9,000 is statistically significant.