Q1

$n = 25$

$\bar{x} = 19.5$

$\sigma = 9.88$

$\alpha = 0.1$

a) $EBM = (z_{\alpha/2})\left(\frac{\sigma}{\sqrt{n}}\right) = (z_{0.05})\left(\frac{9.88}{\sqrt{25}}\right) = 3.251$

$\bar{x} + EBM = 19.5 + 3.251 = 22.751$

$\bar{x} - EBM = 19.5 - 3.251 = 16.249$

The lower and upper confidence limits are 16.249 and 22.751

b) $\hat{p} = \frac{160}{360} = \frac{4}{9}$ $\quad SE = \sqrt{\frac{(4/9)(5/9)}{360}} = 0.026$

$\hat{p} + (2.58)(0.026) = 0.511$

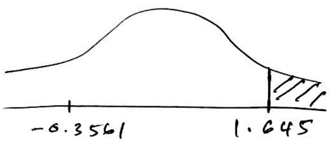
$\hat{p} - (2.58)(0.026) = 0.377$

~~The lower and upper confidence limits are 0.377 and 0.511~~ I am 99% confident that the true proportion of stores that offer special promotions is between 0.377 and 0.511

Q2

a) $H_0 : p = 0.1$

$H_1 : p > 0.1$



$\hat{p} = \frac{33}{350} = 0.09429$

$z = \frac{0.09429 - 0.1}{\sqrt{0.09/350}} = -0.3561$

$c.v. = z_{0.05} = 1.645$

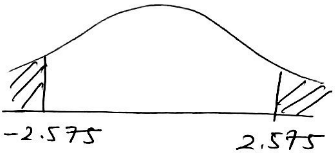
Since $-0.3561 < 1.645$, we fail to reject H_0. We accept the claim that incorrect test result will be less than 10%

Q2

b) $H_0 : \mu = 58000$

$H_1 : \mu \neq 58000$

$$z = \frac{58400 - 58000}{652/\sqrt{16}} = 2.454$$



$$C.V. = z_{0.005} = 2.575$$

Since $-2.575 < 2.454 < 2.575$, we fail to reject H_0. We accept that the true average compressive strength of steel is 58000 psi.

Q3

a) $n = 10$

$\alpha = 0.01$

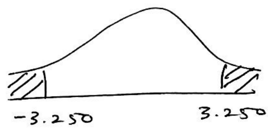
$\bar{x} = 10$

$H_0 : \mu = 10$

$H_1 : \mu \neq 10$

$$\sigma = \sqrt{\frac{0.504}{10-1}} = \sqrt{0.056} = 0.2366$$

$$t = \frac{10.06 - 10}{0.2366/\sqrt{10}} = 0.802$$



$C.V. = t_{0.005,9} = 3.250$

Since $-3.250 < 0.802 < 3.250$, we fail to reject H_0, which means the average content volume of the Brand X car lubricants is not 10 liters.

b) $n = 14$

$\sigma = 0.44$

$\alpha = 0.05$

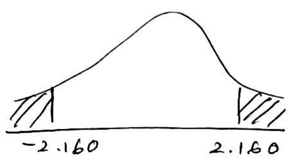
$\bar{x} = 3.654$

$$s = \sqrt{\frac{6.2019}{13}} = \sqrt{0.4771} = 0.6907$$

$H_0 : s = 0.44kg$

$H_1 : s \neq 0.44kg$

$$\chi^2 = \frac{(13)(0.44)^2}{(0.6907)^2} = 5.2755$$



$\chi^2_{0.025,13} = 2.160$

Since $5.2755 > 2.160$, we fail to reject H_0. There is enough evidence to support that the vitamin has effects on the standard deviation of the birth weight.

Scanned with CamScanner

Q4

$n = 101$

$\sigma^2 = 0.18$

$s^2 = 0.165$

$\alpha = 0.05$

$H_0 : \sigma^2 = 0.18$

$H_1 : \sigma^2 < 0.18$

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2} = \frac{(100)(0.165)}{0.18} = 91.667$$

$\chi^2_{0.05,100} = 77.929$

Since $91.667 > 77.929$, we fail to reject Ho. There is sufficient evidence that support the variation of measurement of sheet metal stamping is equal to 0.18 inch². Hence, the new point inspector does not make satisfory measurements.

Q5

$n_1 = 15$

$\bar{x}_1 = 76.40$

$s_1^2 = 25.30$

$n_2 = 18$

$\bar{x}_2 = 71.20$

$s_2^2 = 22.20$

$\alpha = 0.05$

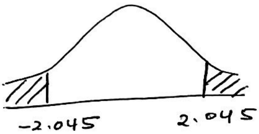
$H_0 : \bar{x}_1 = \bar{x}_2$

$H_1 : \bar{x}_1 \neq \bar{x}_2$

$$t = \frac{76.40 - 71.20 - 0}{\sqrt{\frac{25.30}{15} + \frac{22.20}{18}}} = 3.043$$

$$v = \frac{\left(\frac{25.30}{15} + \frac{22.20}{18}\right)^2}{\frac{\left(\frac{25.30}{15}\right)^2}{14} + \frac{\left(\frac{22.20}{18}\right)^2}{17}} = \frac{8.5264}{0.2926} = 29.14 \approx 29$$

$t_{0.025,29} = 2.045$



Since $3.043 > 2.045$, we reject the null hypothesis Ho. There is evidence to conclude that there is no difference in the mean spending between these two populations in 95% significance level.

Question 6

	Batch 1	Batch 2
no. of observation	16	21
mean	93.6°C	98.5°C
st. d	3.6°C	2.5°C

$H_0 : 6_1^2 = 6_2^2$

$H_1 : 6_1^2 > 6_2^2$

Test statistic:

$S_1^2 = 3.6^2 = 12.96$

$S_2^2 = 2.5^2 = 6.25$

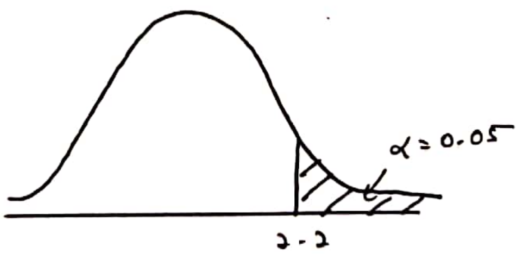
$F = \frac{S_1^2}{S_2^2} = \frac{3.6^2}{2.5^2} = 2.0736$

Df : numerator, $n_1 - 1 = 16 - 1 = 15$

denominator, $n_2 - 1 = 21 - 1 = 20$

$\alpha = 0.05$

$F_{0.05, 15, 20} = 2.20$



$\therefore$ Since $F = 2.0736 < F_{0.05, 15, 20} = 2.20$, we fail to reject the null hypothesis.

We have significant evidence to conclude that the standard deviation from batch1 is not larger than batch 2.

QUESTION 7

before training (x_1)	203	390	389	279	333	213	410	364	470	464
after training (x_2)	225	410	402	285	355	240	444	370	501	490
$D = x_1 - x_2$	-22	-20	-13	-6	-22	-27	-34	-6	-31	-26
$D^2 = (x_1 - x_2)^2$	484	400	169	36	484	729	1156	36	961	676

$H_0: \mu_d = 0$

$H_1: \mu_d < 0$

$\Sigma D = -207$

$\Sigma D^2 = 5131$

~~test statistic: t.~~

$$S_D = \sqrt{\frac{5131 - \frac{(-207)^2}{10}}{9}} = 9.696$$

$$\bar{D} = \frac{\Sigma D}{n} = \frac{-207}{10} = -20.7$$

$$t = \frac{\bar{D} - \mu_D}{\frac{S_D}{\sqrt{n}}} = \frac{-20.7 - 0}{\frac{9.696}{\sqrt{10}}} = -6.751$$

$\alpha = 0.05$, $df = 9$

t-value from table: -1.833

Since $-6.751 < -1.833$, we reject H_0. There is enough evidence that the words spelled correctly after training is higher than before training

Q8

i)

x	y	xy	x^2	y^2
0.27	2	0.54	0.0729	4
1.41	3	4.23	1.9881	9
2.19	3	6.57	4.7961	9
2.83	6	16.98	8.0089	36
2.19	4	8.76	4.7961	16
1.41	2	3.62	3.2761	4
0.85	1	0.85	0.7225	1
3.05	5	15.25	9.3025	25
Total	Total	Total	Total	Total
14.6	26	56.80	32.9632	104

$$r = \frac{(56.80) - (14.6)(26)/8}{\sqrt{[(32.9632) - (14.6)^2/8] \times [(104) - (26)^2/8]}}$$

$$= \frac{9.35}{11.0997} = 0.8424$$

ii) H_0 : No correlation

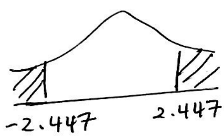
H_1 : Correlation exists

$$t = \frac{0.8424}{\sqrt{\frac{1-(0.8424)^2}{8-2}}} = 3.829$$

$\alpha = 0.05$

$df = 6$

$t_{0.025,6} = 2.447$

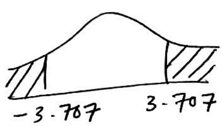


Since $3.829 > 2.447$, ~~the~~ we reject the null hypothesis H_0. Thus, there exist correlation between weight of plastic usage and size of household

iii) $t = 3.829$

$\alpha = 0.01$

$t_{0.005,6} = 3.707$



Since $3.829 > 3.707$, we reject the null hypothesis H_0. Thus, there exist correlation between weight of plastic usage and size of household.

Q9

i) $\Sigma y = 216$

$\Sigma x = 1076$

$\Sigma xy = 25431$

$\Sigma x^2 = 133336$

$\bar{y} = 24$

$\bar{x} = 119.55$

$b_1 = -\dfrac{3537}{42248}$

$b_0 = 24 - \left(\dfrac{-3537}{42248}\right)(119.55) = 34.01$

$\hat{y}_i = 34.01 - 0.08372x$

ii) $y = 34.01 - 0.08372(125)$

$= 23.545$ km

QUESTION 10

memory booster	placebo	without treatment
70	37	3
77	43	10
83	50	17
90	57	23
97	63	30

$\alpha = 0.01$

(1)

$H_0 = M_1 = M_2 = M_2$

H_1 = at least one mean is different

(2)

category 1 (memory booster)

$n = 5$

$\bar{x} = \frac{70+77+83+90+97}{5} = 83.4$

$S = \sqrt{\frac{(70-83.4)^2 + (77-83.4)^2 + (83-83.4)^2 + (90-83.4)^2 + (97-83.4)^2}{4}}$

$= 10.597$

category 2 (placebo)

$n = 5$

$\bar{x} = \frac{37+43+50+57+63}{5} = 50$

$S = \sqrt{\frac{(37-50)^2 + (43-50)^2 + (50-50)^2 + (57-50)^2 + (63-50)^2}{4}}$

$= 10.44$

category 3 (without treatment)

$n = 5$

$\bar{x} = \frac{3+10+17+23+30}{5} = 16.6$

$S = \sqrt{\frac{(3-16.6)^2 + (10-16.6)^2 + (17-16.6)^2 + (23-16.6)^2 + (30-16.6)^2}{4}} = 10.597$

③

$$\bar{\bar{x}} = \frac{83.4 + 50 + 16.6}{3} = 50$$

$$S_{\bar{x}} = \sqrt{\frac{(83.4-50)^2 + (50-50)^2 + (16.6-50)^2}{2}} = 33.4$$

$$n S^2_{\bar{x}} = 5 (33.4)^2$$
$$= 5577.8$$

④

$$S^2_p = \frac{(10.597)^2 + (10.44)^2 + (10.597)^2}{3}$$
$$= 111.195$$

⑤ test statistic, F

$$F = \frac{n s^2_{\bar{x}}}{S^2_p} = \frac{5577.8}{111.195} = 50.162$$

⑥

numerator = $3 - 1 = 2$

denominator = $k(n-1) = 3(5-1) = 3(4)$
$= 12$

⑦ F c.v = 6.9266

since $F_{test} > F_{cv}$ ($50.162 > 6.9266$),

we reject the null hypothesis

∴ there is sufficient evidence to

claim the treatments will

have different effects.