2014 exam (MAST20005), question 5

An eating attitude test (EAT) was administred to both a sample of female models and a control group of females, resulting in the following summary statistics.

	Sample size	Sample mean	Sample standard deviation
Models	30	8.63	7.1
Controls	30	10.97	8.9

You may assume both sample came from normal populations.

(a) Is there sufficient evidence to justify claiming that a difference exists in the mean EAT score between models and controls? Assume that the two populations have equal variance and use a test with significance level $\alpha = 0.05$ and clearly state your null and alternative hypotheses.

(b) Give an approximate p-value for the test in (a).

(c) Is there evidence that the population variances differ between models and controls? Justify your answer by giving an appropriate confidence interval.

The following R output may be useful.

```
> t <- c(0.005, 0.01, 0.025, 0.05, 0.950, 0.975, 0.990, 0.995)
> qt(t, 58)
 -2.66 -2.39 -2.00 -1.67  1.67  2.00  2.39  2.66
> qnorm(t)
 -2.58 -2.33 -1.96 -1.64  1.64  1.96  2.33  2.58
> qt(t, 29)
 -2.76 -2.46 -2.05 -1.70  1.70  2.05  2.46  2.76
> qf(t, 29, 29)
  0.37  0.41  0.48  0.54  1.86  2.10  2.42  2.67
> qf(t, 58, 58)
  0.50  0.54  0.59  0.65  1.55  1.68  1.86  1.99
```

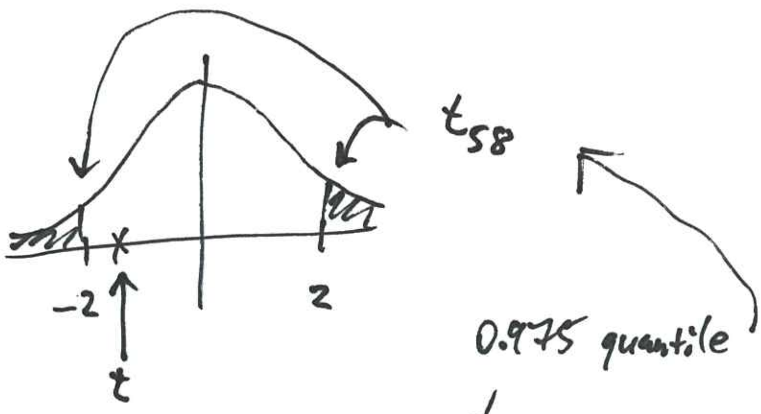
2014 exam (MAST 20005), Q 5

(a) $H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$

$$S_p = \sqrt{\frac{29 \times 4.1^2 + 29 \times 5.9^2}{58}} = 5.08$$

$$t = \frac{8.63 - 10.97}{5.08\sqrt{\frac{1}{30} + \frac{1}{30}}} = -1.784$$

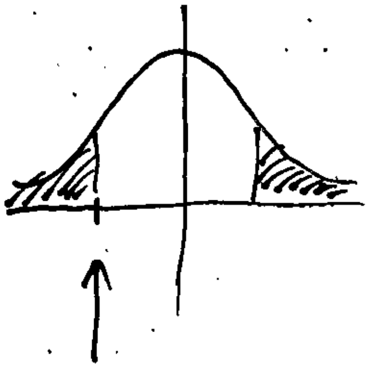


$$|t| = |-1.784| < 2$$

Do not reject H_0.

(b) $p\text{-value} = Pr(|T| > 1.784)$

$$= 2 \times Pr(T < -1.784)$$



-1.784

$$\underset{\substack{\| \\ 0.025}}{Pr(T<-2)} < Pr(T < -1.784) < \underset{\substack{\| \\ 0.05}}{Pr(T<-1.67)}$$

$$\underbrace{0.05 < \underset{\substack{\uparrow \\ p\text{-value}}}{2 \times Pr(T<-1.784)} < 0.1}$$

(c)

$$0.95 = Pr\left(c < \frac{S_Y^2/\sigma_Y^2}{S_X^2/\sigma_X^2} < d \right)$$

$F_{29,29}$: $c \xrightarrow{0.025} 0.48$, $d \xrightarrow{0.975} 2.10$

$$= Pr\left(0.48 \frac{S_X^2}{S_Y^2} < \frac{\sigma_X^2}{\sigma_Y^2} < 2.1 \frac{S_X^2}{S_Y^2} \right)$$

$$\frac{S_X^2}{S_Y^2} = \frac{4.1^2}{5.9^2}$$

95% CI: $(0.23, 1.01)$