$\bar{y}_{..} = 15.04$

1).

Cotton Weight Percent	Observations	
15	7 7 15 11 9	$\bar{y}_{1.} = 9.8$
20	12 17 12 18 18	$\bar{y}_{2.} = 15.4$
25	14 19 19 18 18	$\bar{y}_{3.} = 17.6$
30	19 25 22 19 23	$\bar{y}_{4.} = 21.6$
35	7 10 11 15 11	$\bar{y}_{5.} = 10.8$

a) Is there evidence to support the claim that cotton content affects the mean tensile strength? Use $\alpha = 0.05$

Source	SS	df	MS	F_0
Between Trt	475.76	4	118.94	14.75672
Error (Within Trt)	161.20	20	8.06	
Total	636.96	24		

$$SS_{trt} = \sum_{1}^{a}\sum_{1}^{n}\left(\bar{y}_{i.} - \bar{y}_{..}\right)^2$$

$$= \sum_{1}^{a} n\left(\bar{y}_{i.} - \bar{y}_{..}\right)^2$$

$$= \frac{1}{n}\sum_{1}^{a} y_{i.}^2 - \frac{y_{..}^2}{N}$$

$$= \frac{1}{5}\left(49^2 + 77^2 + 88^2 + 108^2 + 54^2\right) - \frac{376^2}{25}$$

$$= \frac{1}{5}(30{,}654) - \frac{141376}{25}$$

$$= 6{,}130.8 - 5655.04$$

$$= 475.76$$

$$SS_{Tot} = \sum_{1}^{a}\sum_{1}^{n} y_{ij}^2 - \frac{(y_{..})^2}{N}$$

$$= 6292 - \frac{141376}{25}$$

$$= 6292 - 5655.04$$

$$= 636.96$$

P-value $= 9.13 \times 10^{-6}$

With a p-value less than 0.05, there is evidence to reject the null hypothesis that all the group means are the same. There is evidence to suggest that the tensile strength is affected by cotton weights.

b) Use the Fisher LSD method to make comparisons between the pairs of means. What conclusions can you draw?

$$LSD = t_{0.025, N-a}\sqrt{\frac{2MS_E}{n}} = t_{0.025, 20}\sqrt{\frac{2(8.06)}{5}} = 2.086\sqrt{\frac{2(8.06)}{5}} = 2.086(1.79555)$$

$$= 3.745517$$

$\bar{y}_1 - \bar{y}_2 = 9.8 - 15.4 = -5.6$ ★ $\quad \bar{y}_1 - \bar{y}_3 = 9.8 - 17.6 = -7.8$ ★ $\quad \bar{y}_1 - \bar{y}_4 = 9.8 - 21.6 = -11.8$ ★ $\quad \bar{y}_1 - \bar{y}_5 = 9.8 - 10.8 = -1$

$\bar{y}_2 - \bar{y}_3 = 15.4 - 17.6 = -2.2$ $\quad \bar{y}_2 - \bar{y}_4 = 15.4 - 21.6 = -6.2$ ★ $\quad \bar{y}_2 - \bar{y}_5 = 15.4 - 10.8 = 4.6$ ★

$\bar{y}_3 - \bar{y}_4 = 17.6 - 21.6 = -4$ ★ $\quad \bar{y}_3 - \bar{y}_5 = 17.6 - 10.8 = 6.8$ ★ $\quad \bar{y}_4 - \bar{y}_5 = 21.6 - 10.8 = 10.8$ ★

There is evidence to suggest 20, 25, and 30 are different from 15. 30 and 35 are different from 20. 30 and 35 are different from 25. 35 is different from 30.