11.1.4.

$$SST = SSTr + SSE \quad . \quad F\text{-value} = \frac{MSTr}{MSE}$$

.) Let's find SSTr & SSE.

$$SST = \sum_{k=1}^{7} \sum_{j=1}^{12} (x_{ij} - \bar{x}_{..})^2$$

$$= \sum_{k=1}^{7} \cdot 12 \cdot (\bar{x}_{k.} - \bar{x}_{..})^2 + \sum_{k=1}^{7} \sum_{i=1}^{12} (x_{kj} - \bar{x}_{i.})^2$$

SSTr. - calculable.   SSE

since. $\bar{x}_{..} = \dfrac{\sum_{k=1}^{7} \bar{x}_{i.}}{7} = 8.261429$, $\quad$ SSTr $= 7.613824...$

then. SSE $= 125.77$

$$F\text{-value} = \frac{MSTr}{MSE} = \frac{SSTr / k-1}{SSE / n-k} \approx 0.7769 \sim F_{6.77}$$

∴ p-value $= 0.59$.

11.1.8

(a). $\left(\mu_{i_1} - \mu_{i_2} - \dfrac{q_{\alpha, k, v.}}{\sqrt{2}} \cdot \sigma \sqrt{\dfrac{1}{n_{i_1}} + \dfrac{1}{n_{i_2}}} \;,\; \mu_{i_1} - \mu_{i_2} - \dfrac{q_{\alpha, k, v.}}{\sqrt{2}} \cdot \sigma \sqrt{\dfrac{1}{n_{i_1}} + \dfrac{1}{n_{i_2}}} \right)$

Suppose that. $\mu_1 = \mu_2 = \mu_3$, & $\sigma_1 = \sigma_2 = \sigma_3$.

Then. $MSE = \hat{\sigma}^2 = 4.96.$

$\left. \rule{0pt}{40pt} \right] = \dfrac{q_{\alpha, k, v.}}{\sqrt{2}} \sigma \cdot \sqrt{\frac{1}{11} + \frac{1}{11}} \approx 2.34352.$

$\dfrac{q_{0.05, 3, 30}}{\sqrt{2}} = \dfrac{3.49}{\sqrt{2}} = 2.46780.$

$\Rightarrow$ C.I of $x_1 - x_2$: $(3.31 - 2.34352 \quad, \quad 3.31 + 2.34352\quad)$

C.I. of $x_2 - x_3$: $(-4.37 - 2.34352 \quad, \quad -4.37 + 2.34352\quad)$

C.I. of $x_3 - x_1$: $(1.06 - 2.34352 \quad, \quad 1.06 + 2.34352\quad)$

$\Rightarrow x_1, x_3$ 는 구별되지 않다.

(b)

44.74	48.05.	49.11	
$\overline{x_2}$	$\overline{x_1}$	$\overline{x_3}$	
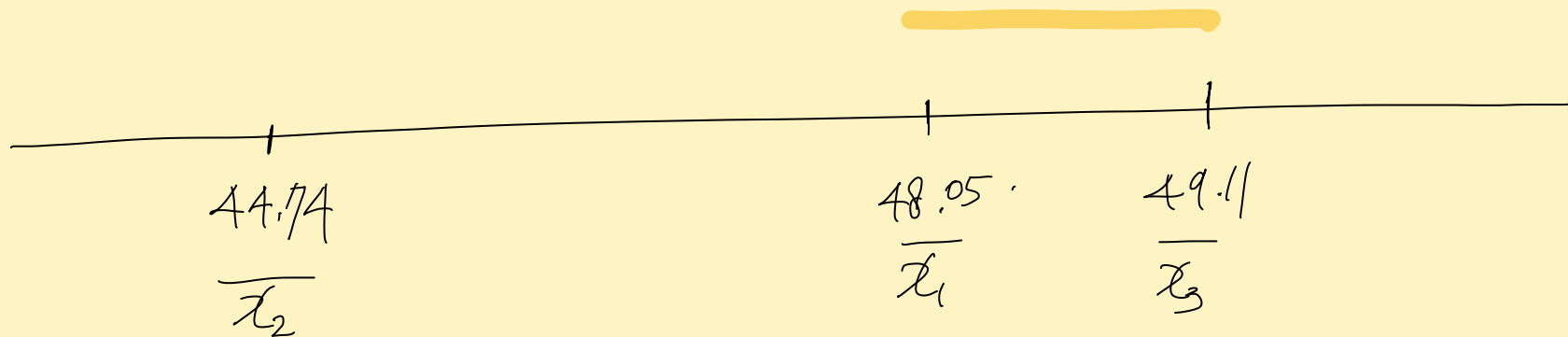
(c) $= L = \sqrt{2} \cdot q_{0.05, 3, 11} \cdot \sigma \sqrt{\dfrac{1}{11 + \frac{n}{3}} + \dfrac{1}{11 + \frac{n}{3}}} < 2.0.$ * 새로운 sampling은 _ 분포에 골고루 들어간다고 가정.

$2 \left(\dfrac{\sqrt{2}}{2} \cdot q_{0.05, 3, 11} \sigma \right)^2 < \cdot \left(11 + \dfrac{n}{3}\right) \Leftrightarrow 57.6197 < n.$ ∴ 58 개의 추가 sampling.

#11.1.16

F-value: explain how the different layouts affect the time.

$$MSTr = \frac{SSTr}{k-1} \quad , \quad F\text{-value} = \frac{MSTr}{MSE}$$

$$SSTr = \sum_{i=1}^{3} n_i \left(\overline{x}_{i\cdot} - \overline{x}_{\cdot\cdot} \right)^2$$

$$= 12 \cdot (25.125 - 26.21212)^2 + 10 \cdot (29.11 - 26.21212)^2$$
$$+ 11 \cdot (24.7636 - 26.21212)^2$$

$$= 121.2382.$$

$$SSE = 34.417.$$

$$\therefore MSTr = \frac{121.2382}{2} \approx 60.619 \quad , \quad MSE = \frac{34.417}{30} \approx 1.147$$

$$F\text{-value} = 52.85 \cdot \sim F_{2,30}. \qquad p\text{-value} = 0. \quad \cdots$$
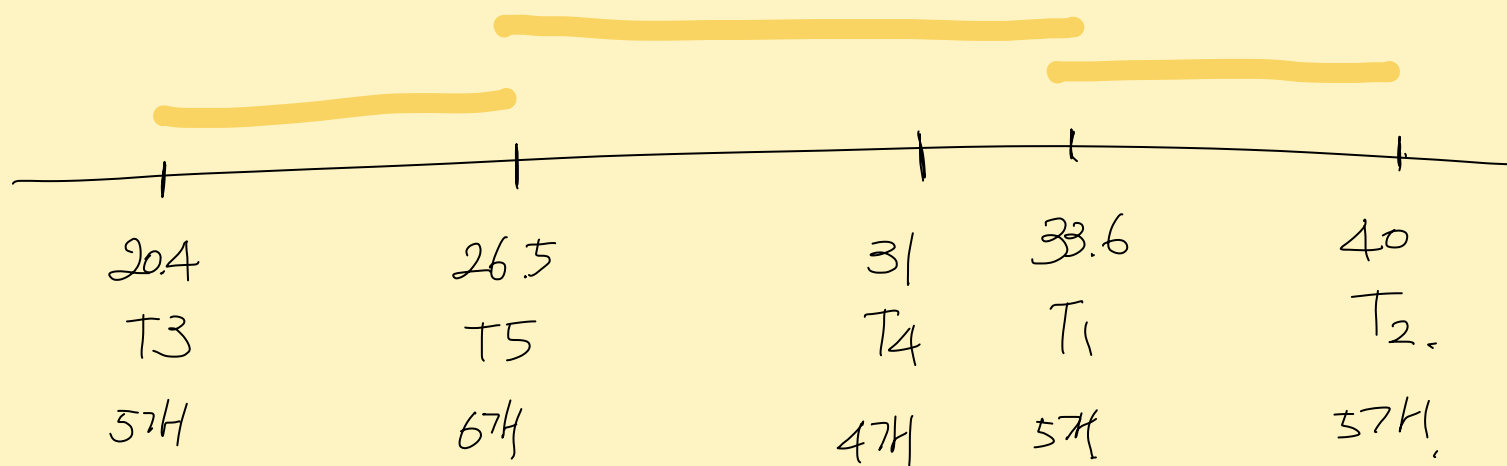
$$\Rightarrow \text{different layout affect . many.}$$

#11.1.20.

(a)

	SS	df	MS	F
Group	1102.74	4	275.685	18.50855.
error	297.9	20	14.895	
Total.	1400.64	24		

p-value ≈ 0.

(b) Since $\dfrac{q_{0.05,5,20}}{\sqrt{2}} = 2.99106\ldots$, $\hat{\sigma} = \sqrt{MSE} = 3.85940$.

T_2's treatment effect is largest, T_3's is smallest.
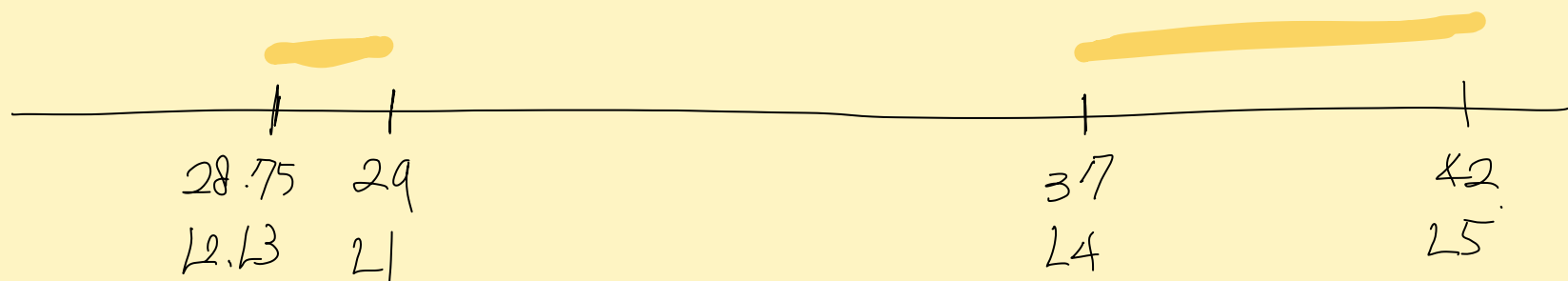
11.1.24.

$H_0: \mu_1 = \cdots = \mu_5$, $\qquad$ $H_\alpha: H_0$ is not.

Check F-test.

	SS	df	MS	F
Group	596.3	4	149.075	24.4385.
error	91.5	15	6.1	
Total.	687.8	19		

p. value ≈ 0.

∴ There is evidence that some location is different about E.coli pollution level

Since $q_{0.05,5,15} = 4.37$, $\hat{\sigma} = \sqrt{MSE} = 2.4698$. $\frac{L}{2} = 5.3965\overline{13}$


```
          28.75   29                        37              42.
          L2.L3   L1                        L4              L5
```

L_5 has hightest, L_2/L_3 has smallest. E.coli level