MATH 204 - ASSIGNMENT 1: SOLUTIONS

(a) To compute the ANOVA-F statistic by hand, use the formulae from the notes, in particular,

$$\text{MST} = \frac{\text{SST}}{k-1} \qquad \text{MSE} = s_P^2 = \frac{\text{SSE}}{n-k} \qquad F = \frac{\text{MST}}{\text{MSE}}$$

To complete the test, we need to compare this with the Fisher-F$(k-1, n-k)$ distribution. The $\alpha = 0.05$ critical value, C_R is given by SPSS to be $F_\alpha(4, 137) = 2.62$. The McClave and Sincich tables do not tabulate this Fisher-F distribution, but we do know that $F_\alpha(4, \infty) < F_\alpha(4, 137) < F_\alpha(4, 120)$. Using SPSS we can also compute all the quantities, including the p-values. We conclude that the test of equality of means is

- REJECTED for TCL1A ($p = 0.000$)
- NOT REJECTED for IRF5 ($p = 0.703$)
- REJECTED at $\alpha = 0.05$ but NOT REJECTED at $\alpha = 0.01$ for DAPK1 ($p = 0.012$)

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
TCL1A	Between Groups	95.446	4	23.861	25.103	.000
	Within Groups	130.225	137	.951		
	Total	225.671	141			
IRF5	Between Groups	2.794	4	.698	.546	.703
	Within Groups	175.393	137	1.280		
	Total	178.187	141			
DAPK1	Between Groups	3.554	4	.888	3.341	.012
	Within Groups	36.427	137	.266		
	Total	39.981	141			

5 Marks for each ANOVA table and test

(b) The pooled estimates of variance can be obtained from the fact that $s_P^2 = \text{MSE}$, so we have the three estimates, 0.951, 1.280 and 0.266 respectively, that is, the variances are rather different in the three cases.

2 Marks

Checking the Assumptions:

(i) Independent samples: there is no direct information given in the question, but there is nothing to suggest that this assumption is not met.

(ii) Normality of the populations: visual inspection of the boxplots below provides no categorical evidence that the normality assumption is violated, although perhaps there is some skewness evident in one or two of the boxplots, and perhaps a couple of outliers.

(iii) Equal Variances: Levene's test implies that the equality of variances is not rejected at the $\alpha = 0.05$ level for the first two genes, but there is evidence for the third gene that this assumption may be questionable, as the hypothesis of equal variances is rejected at this level

3 Marks

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
TCL1A	2.288	4	137	.063
IRF5	1.342	4	137	.258
DAPK1	2.473	4	137	.047