Assignment 3

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Q3.

Face Value	Unbiased Distribution f(x)	Expected freq (E)	Observed freq (O)	$(O-E)^2$	$\frac{(O-E)^2}{E}$
1 (A)	0.09	54.09	77	524.86	9.70
2 (B)	0.27	164.31	150	204.69	1.25
3 (C)	0.36	216.24	210	38.89	0.18
4 (D)	0.21	123.29	125	2.92	0.02
5 (F)	0.05	30.46	38	56.91	1.87
$\eta = 4$		sum = 588.38	sum = 600		$\chi^2 = 13.02$

So, from the calculation we can see that the χ^2 value is 13.02.

From the table of χ^2_{crit} values, we can see that for $\eta = 4$ for 5% significance level, the χ^2_{crit} value is 9.488 and for 10% significance level, the χ^2_{crit} value is 7.779. In both the cases $\chi^2 > \chi^2_{crit}$ which means that we reject the null hypothesis. Hence, the grade distribution is not unbiased.

Q4.

By the given data, we have the following values for f_1 and f_2:

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f1 = [4.65, 4.84, 4.59, 4.75, 4.63, 4.75, 4.58, 4.82, 4.86, 4.60, 4.77, 4.65, 4.80]
f2 = [4.75, 4.79, 4.74, 4.74, 4.77, 4.58, 4.81]
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mean of $f_1 = 4.715$ and $f_2 = 4.740$
std of $f_1 = 0.097$ and $f_2 = 0.070$

t-test

The t-test is used to determine if there is a significant difference between the means of two groups. We know that the t-value is given by:

$$t = \frac{\mid \mu_1 - \mu_2 \mid}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

where μ_1 and μ_2 are the means of the two groups, s_1 and s_2 are the standard deviations of the two groups, and n_1 and n_2 are the number of samples in the two groups.

Here, $\mu_1 = 4.715$ and $\mu_2 = 4.74$ are the means of the two groups, $s_1 = 0.0973$ and $s_2 = 0.0697$ are the standard deviations of the two groups, and $n_1 = 13$ and $n_2 = 7$ are the number of samples in the two groups. So the t-value becomes:

$$t = \frac{\mid 4.715 - 4.74 \mid}{\sqrt{\frac{0.0973^2}{13} + \frac{0.0697^2}{7}}} = 0.673$$

now, we know that the degree of freedom is given by: $DOF = (n_1 - 1) + (n_2 - 1) = 12 + 6 = 18$

Now, at $\alpha = 0.1$, and $DOF = 18$, the t_{crit} value is 2.887. Since $t < t_{crit}$, we fail to reject the null hypothesis. Hence, we can say that the two groups are **NOT significantly different** and come from the same population.

f-test

The f-test is used to determine if the variances of two groups are significantly different. We know that the f-value is given by:

$$f = \frac{s_1^2}{s_2^2}$$

where s_1 and s_2 are the standard deviations of the two groups. Here, $s_1 = 0.0973$ and $s_2 = 0.0697$ are the standard deviations of the two groups. So the f-value becomes:

$$f = \frac{0.0973^2}{0.0697^2} = 1.95$$

Now, at $\alpha = 0.1$, and $DOF = 18$, the f_{crit} value is 2.9047. Since $f < f_{crit}$, we fail to reject the null hypothesis. Hence, we can say that the two groups have been drawn from populations with **equal variances**.