One-Way ANOVA:

A CASE STUDY: Social Well-being across different education level

15

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One-Way Analysis of Variance (ANOVA) is a statistical technique used to determine whether there are any statistically significant differences between the means of three or more independent (unrelated) groups. It extends the independent t-test to multiple groups.

Here's how One-Way ANOVA works:

1. **Null Hypothesis**(H_0): The null hypothesis states that there is no significant difference between the means of the groups. Mathematically, H_0: $\mu_1=\mu_2=\ldots=\mu_k$, where μ_i represents the mean of the i^{th} group.

2. **Alternative Hypothesis** (H_1): The alternative hypothesis proposes that there is at least one significant difference between the means of the groups. Depending on the nature of the study, H_1 can take different forms.

3. **Assumptions**:

- Independence: Observations within each group are independent of each other.

- Normality: The data within each group should be approximately normally distributed.

- Homogeneity of Variance: The variances of the populations from which the groups are sampled should be equal (homoscedasticity).

4. **Test Statistic**: The F-statistic is used for testing the significance of differences between group means in ANOVA. It is calculated as:

$F= MS_{between} /MS_{within}$

where:

- $MS_{between}$ (Mean Square between groups) measures the variation between the group means, calculated as $MS_{between}= SS_{between}/df_{between}$.

- MS_{within} (Mean Square within groups) measures the variation within each group, calculated as $MS_{within} = SS_{within}/df_{within}$.

- $SS_{between}$ is the sum of squares between groups.

- SS_{within} is the sum of squares within groups.

- $df_{between}$ is the degrees of freedom for the between-groups variation, which is k-1(where k is the number of groups).

- df_{within} is the degrees of freedom for the within-groups variation, which is N-k (where N is the total number of observations).

5. **Decision**: Compare the calculated F-statistic to the critical F-value from the F-distribution table or use software to obtain the p-value. If the p-value is less than the significance level (often denoted asα, typically 0.05), then there is sufficient evidence to reject the null hypothesis and conclude that there is a significant difference between the means of at least two groups.

One-Way ANOVA is commonly used in research across various disciplines to compare means of multiple groups simultaneously and to determine whether there are significant differences among them. If ANOVA indicates significant differences, further post-hoc tests (e.g., Tukey's HSD, Bonferroni, etc.) can be conducted to identify which specific groups differ from each other.

The Problem

To investigate, Social Well-being differs across different levels within the education (Illiterate, Sr Secondary, Graduate, Post graduate)

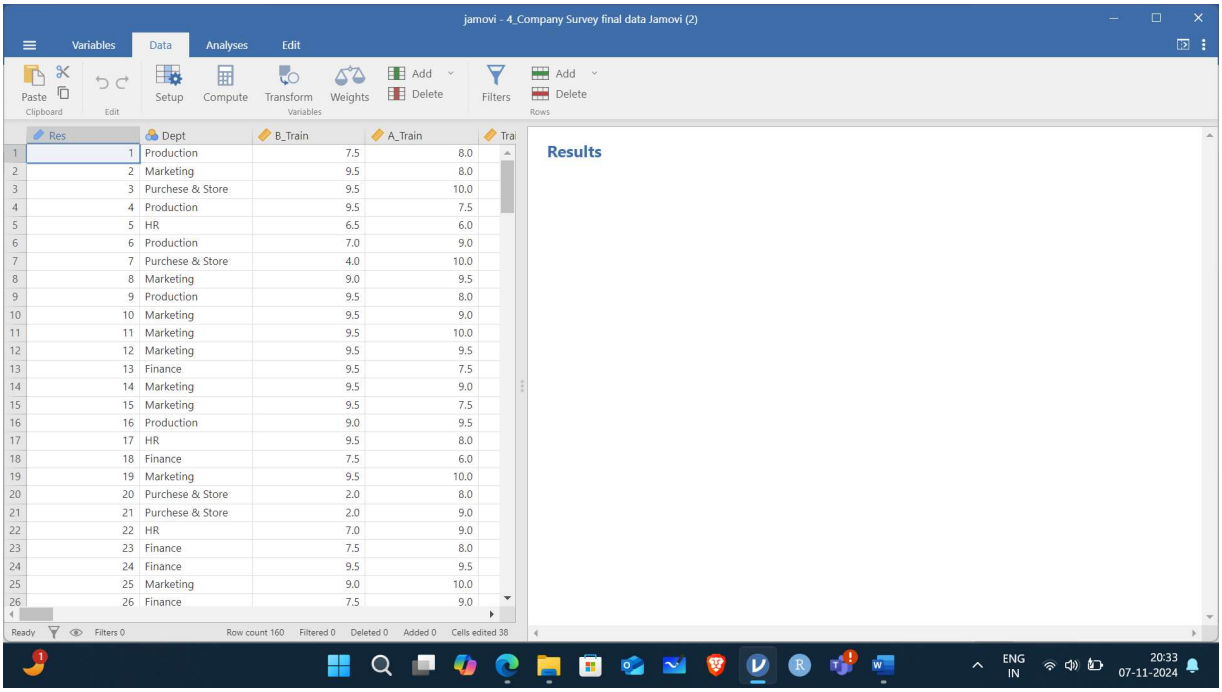
Data

Download **Survey Data** file form the given link https://dsdhakre.in/Datafiles.html

Hypothesis

H_0: There is no significance difference in Social Well-being across different education level (Illiterate, Sr Secondary, Graduate, Post graduate)

Steps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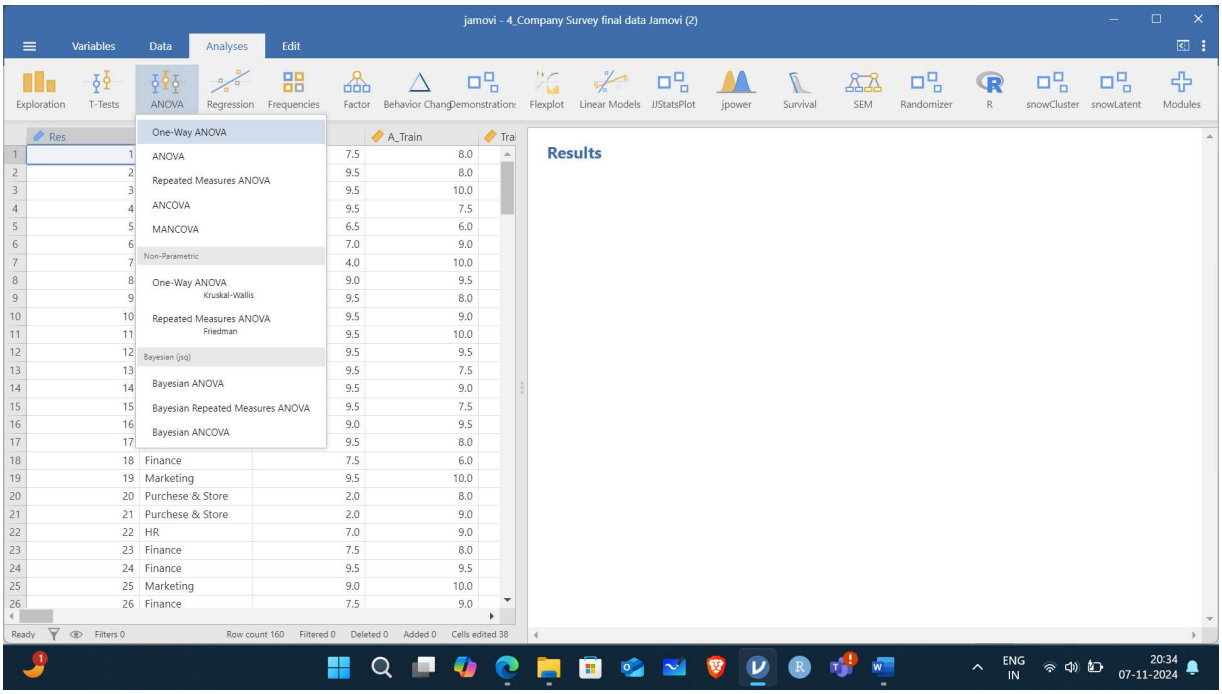
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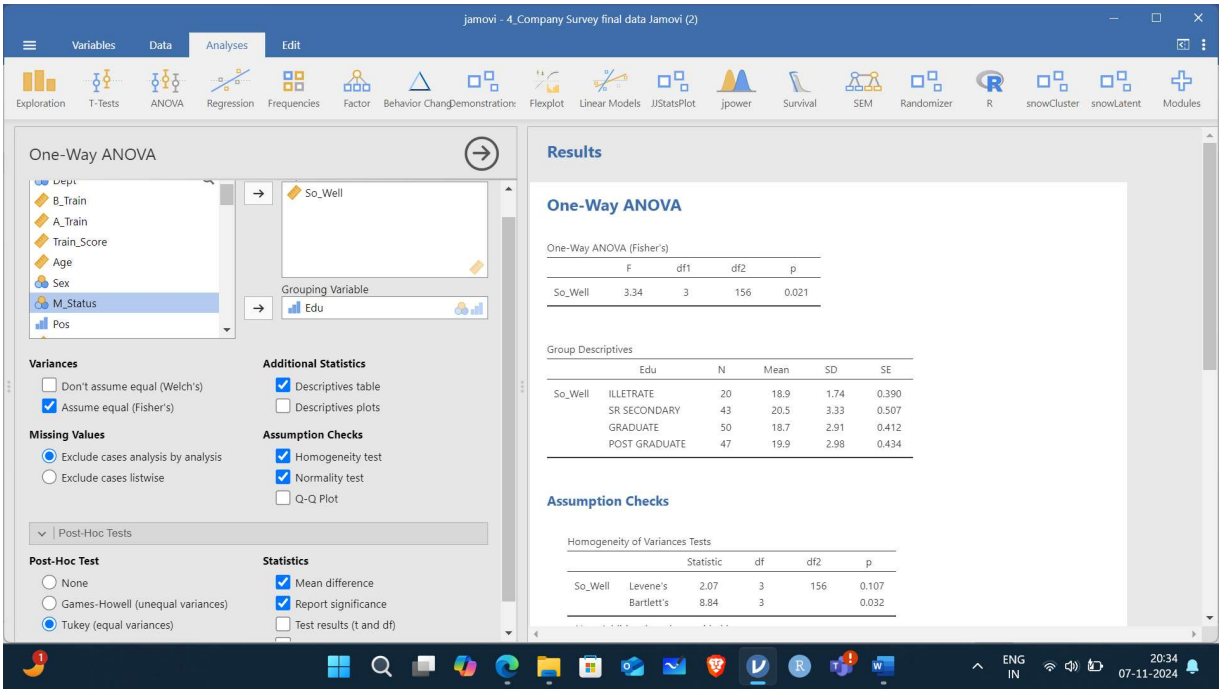
Regression
Frequencies
Factor
Flexplot
Linear Models
SEM
Randomizer
R
snowCluster
snowLatent
Modules
One-Way ANOVA
ANOVA
Repeated Measures ANOVA
ANCOVA
MANCOVA
Non-Parametric
One-Way ANOVA
Kruskal-Wallis
Repeated Measures ANOVA
Friedman
Bayesian (jsq)
Bayesian ANOVA
Bayesian Repeated Measures ANOVA
Bayesian ANCOVA
Results



Reporting

The hypothesis tests the Social Well-being of employee's differs across different education levels. Employee were divided into four groups (Group 1:Illiterate; Group 2: Sr Secondary; Group 3: Graduate; Group 4: Post graduate). The ANOVA results suggest that the Physical Well-being score of the groups differ significantly ($F_{3,156} = 3.34$, p= **0.021**).

Since the Levene's Statistic is not significant, the equal variance was assumed. To check for individual difference between groups post-hoc comparisons were assessed using Tukey Post-Hoc Test. The test indicated that the mean score for Sr Secondary (M =20.5, SD = 3.33) was significantly different form Graduate (M =18.7, SD = 42.91). The mean differences were significantly at 0.05 level. However, no significant differences were detected between others.

Table one way ANOVA Results

Test of Homogeneity of Variances				ANOVA		
Education Levels	Mean	Std. Deviation	Levene's Statistic	Sig.	F	Sig.
Illiterate	18.9	1.74	2.07	0.107	3.34	0.021
Sr Secondary	20.5	3.33				
Graduate	18.7	2.91				
Post Graduate	19.9	2.98				

Group Difference

Education levels	Mean difference	Sig
Sr Secondary-Graduate	1.785	0.021