JOB SATISFACTION

DATA ANALYSIS

[DATE]

STUDENT NAME

Job Satisfaction

Tasks:

1. **Introduction– Introduce the business problems. (10 marks)**
   - i. Describe the main objectives of the researchers who collected this dataset (1 marks)
   - ii. Describe how you want to achieve these objectives in this assignment (1 marks)
   - iii. List all statistical hypotheses you want to test in this assignment and indicate how the hypotheses are related to the research objective above.
     (Note: you can put the hypotheses you are going to test in a table with names of the tests and purpose of the tests) (8 marks)
     Hint: you should write this section after you finish all the following tasks.

Answer 1- (i): The objective of the study is that the how job is satisfied for employees in a large company that operates in many different countries/regions (such as east, west, south, north). Also, how life happiness score talks about the job satisfaction, etc.

(ii): After collecting the data set regards their job satisfaction, stylish action plan can make it easier to achieve these objectives.

(iii): List of statistical hypotheses shown below:

a. Null Hypothesis: There is no difference in Job satisfaction after training at any level of promotion.

   Alternative Hypothesis: There is a difference in Job satisfaction after training at any level of promotion.

   Test: Chi-Square Test

Observed	Expectation	O-E	(O-E)^2	((O-E)^2)/E
35	24.84	10.1600	103.2256	4.1556
68	52.44	15.5600	242.1136	4.6170
83	84.87	-1.8700	3.4969	0.0412
21	37.95	-16.9500	287.3025	7.5706
0	6.90	-6.9000	47.6100	6.9000
1	11.16	-10.1600	103.2256	9.2496
8	23.56	-15.5600	242.1136	10.2765
40	38.13	1.8700	3.4969	0.0917
34	17.05	16.9500	287.3025	16.8506

10	3.10	6.9000	47.6100	15.3581
			=Chi-Square	**75.111**
			=p-value	**0.000**
			=Chi-sq (X^2) value	**9.488**

The Chi-square (calculated) value is greater than the Chi-square tabulated value, so we can reject the null hypothesis. On the other hand, the p-value is close to zero which indicates that it is less than the level of significance. So, based on the above evidence, we can reject the H0, and support alternative hypothesis. Thus, we can conclude that there is a difference in Job satisfaction after training at any level of promotion.

b. Null Hypothesis: Salary is related to life happiness is truly equal to zero

Alternative Hypothesis: Salary is related to life happiness is truly different from zero

Test: One-Way ANOVA

We use ANOVA to test if there is a statistically significant difference in salary with respect to life happiness. Salary will serve as the dependent variable, and life happiness will act as the independent variable.

One factor ANOVA					
	Mean	*n*	*Std. Dev*		
	52.4	300	9.13	Salary(000)	
	5.6	300	1.82	Life Happiness Score (1-10)	
	29.0	600	24.33	Total	
ANOVA table					
Source	*SS*	*df*	*MS*	*F*	*p-value*
Treatment	3,28,723.23	1	3,28,723.227	7593.75	0.0000
Error	25,886.61	598	43.289		
Total	3,54,609.83	599			

We conclude that the mean salary is statistically significantly different for at least one of the life happiness scores ($F_{1, 598} = 7593.75$, $p < 0.05$).

c. H0: There is no difference in between the job satisfaction before training and job satisfaction after training.

H1: There is a difference in between the job satisfaction before training and job satisfaction after training.

Test: Chi-Square Test

Observed	Expectation	O-E	(O-E)^2	((O-E)^2)/E
3	3.10	-0.10	0.01	0.003
3	3.73	-0.73	0.54	0.144
3	2.30	0.70	0.49	0.213
1	0.80	0.20	0.04	0.050
0	0.07	-0.07	0.00	0.067
19	17.05	1.95	3.80	0.223
23	20.53	2.47	6.08	0.296
11	12.65	-1.65	2.72	0.215
1	4.40	-3.40	11.56	2.627
1	0.37	0.63	0.40	1.094
34	38.13	-4.13	17.06	0.447
49	45.92	3.08	9.49	0.207
31	28.29	2.71	7.34	0.260
8	9.84	-1.84	3.39	0.344
1	0.82	0.18	0.03	0.040
24	23.56	0.44	0.19	0.008
29	28.37	0.63	0.39	0.014
15	17.48	-2.48	6.15	0.352
8	6.08	1.92	3.69	0.606
0	0.51	-0.51	0.26	0.507
13	11.16	1.84	3.39	0.303
8	13.44	-5.44	29.59	2.202
9	8.28	0.72	0.52	0.063
6	2.88	3.12	9.73	3.380
0	0.24	-0.24	0.06	0.240
			=Chi-Square	13.905
			=p-value	0.949
			=Chi-square (X2) value	26.2962276

The Chi-square (calculated) value is less than the Chi-square tabulated value, so we cannot reject the null hypothesis. On the other hand, the p-value is greater which indicates that it is more than the level of significance. So, based on the above evidence, we cannot reject the H0, and does not support alternative hypothesis. Thus, we can conclude that there is no difference between the Job satisfaction before training and after training.

2. **Do you think Salary is gender-biased? (10 marks)**
   i. Formulate a statistical hypothesis to test the gender-unbiasedness of payment (2 marks)
   ii. Run the statistical test of the hypothesis (5 marks)
   iii. Conclude your test result (3 marks)

Answer 2: (i)- Set up hypothesis:

Null Hypothesis: Salary is gender biased i.e., truly equal to zero.

Alternative Hypothesis: Salary is gender un-biased i.e., truly not equal to zero.

(ii): Test: Independent Groups (t-test)

Hypothesis Test: Independent Groups (t-test, pooled variance)		
Gender	Salary(000)	
1.62	52.42	mean
0.49	9.13	std. dev.
300	300	n
	598	df
	-50.803	difference (Gender - Salary(000))
	41.759	pooled variance
	6.462	pooled std. dev.
	0.528	standard error of difference
	0	hypothesized difference
	-96.286	t
	0.0000	p-value (two-tailed)

(iii): We can conclude the result based on the p-value. Thus, the p-value is close to zero which indicates that it is less than the level of significance (i.e., 0.05 > 0.00). Therefore, we can reject the null hypothesis and support the alternative hypothesis.

Further, in the sample data, we will use two variables: gender and salary. The variable gender has values of either “1” (male) or "2" (female). It will function as the independent variable in this T test. The variable salary is a numeric variable, and it will function as the dependent variable. The negative t value tells than the mean of female is less than the male. Hence, we conclude that the variance in salary of males is statistically significantly different than that of females.

3. Do you think Salary is City area-dependent? (10 marks)

i. Formulate the test of equal Salary across all City areas (5 marks)
ii. Run the ANOVA test (8 marks)
iii. Interpret your results (3 marks)

Answer (i): Null Hypothesis: There is no difference between Salary across all City areas i.e., is truly equal to zero.

Alternative Hypothesis: There is a difference between Salary across all City areas i.e., is truly equal to zero.

(ii) ANOVA Test:

One factor ANOVA

	Mean	*n*	*Std. Dev*	
	2.7	300	1.40	City Area
	52.4	300	9.13	Salary(000)
	27.6	600	25.71	Total

ANOVA table

Source	*SS*	*df*	*MS*	*F*	*p-value*
Treatment	3,70,463.80	1	3,70,463.802	8692.23	0.0000
Error	25,486.82	598	42.620		
Total	3,95,950.63	599			

(iii) We use ANOVA to test if there is a statistically significant difference in salary with respect to city areas (from 1 to 5). Salary will serve as the dependent variable, and city area will act as the independent variable.

The p-value of the test is 0.000 which is less than the level of the significance i.e., 0.00 < 0.05. Therefore, based on the above evidence, we can reject the null hypothesis and support the alternative hypothesis. Thus. we conclude that the mean salary is statistically significantly different for at least one of the city areas ($F_{1, 598} = 8692.23$, $p < 0.05$).

4. **Do you think the training improves the job satisfaction? (20 marks)**
   i. Formulate a statistical test to support your opinion (3 marks)
   ii. What is your null hypothesis and what is your alternative hypothesis? (2 marks)
   iii. What is your chosen significance level of the test? (1 mark)
   iv. Show your test workings (4 marks)
   v. Critically Interpret the test result (2 marks)
   vi. Show an alternative way of test. (8 marks)

Answer (i): Without any statistical test, we cannot tell that the training improves the job satisfaction or not. However, the given statement may true, because training enhance the level of skill which result job satisfaction level is higher. The statistical test will **One sample T-test for Proportion** use.

(ii). Null Hypothesis: there is no difference in job satisfaction after training.

Alternative Hypothesis: there is a difference in job satisfaction after training.

(iii) The chosen significance level of the test or alpha is 5% or 0.05.

(iv): Test Working:

Hypothesis Test: Mean vs. Hypothesized Value	
0.000	hypothesized value
3.243	mean Job Satisfaction Score after training(1-5)
0.997	std. dev.
0.058	std. error
300	n
299	df
56.343	t
0.0000	p-value (two-tailed)

(v) The p-value of the test is 0.000 which is less than the level of the significance i.e., 0.00 < 0.05. Therefore, based on the above evidence, we can reject the null hypothesis and support the alternative hypothesis. Thus. we conclude that the training improves the job satisfaction. Additionally, in part (i), the judgmental statement or opinion is true.

(vi) Alternative way: One sample Test

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Job Satisfaction Score after training (1-5)	300	3.24	.997	.058

One-Sample Test						
	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Job Satisfaction Score after training (1-5)	56.343	299	.000	3.243	3.13	3.36

The p-value of the test is 0.000 which is less than the level of the significance i.e., 0.00 < 0.05. Therefore, based on the above evidence, we can reject the null hypothesis and support the alternative hypothesis.

5. Do you think promotion is gender biased? (10 marks)

I. Create a two-way table of Gender and Promotion. (2 marks)
II. Formulate the statistical test of independence: the null hypothesis and the alternative hypothesis (2 marks)
III. Run the test (4 marks)
IV. Interpret the results (2 marks)

Answer 5: (I): Two-way Table of Gender and Promotion

Gender * Promoted Crosstabulation					
			Promoted		Total
			No	Yes	
Gender	1	Count	39	75	114
	2	Count	54	132	186
Total		Count	93	207	300

II. Null Hypothesis: There is no difference in between Gender and Promotion

Alternative Hypothesis: There is a difference in between Gender and Promotion

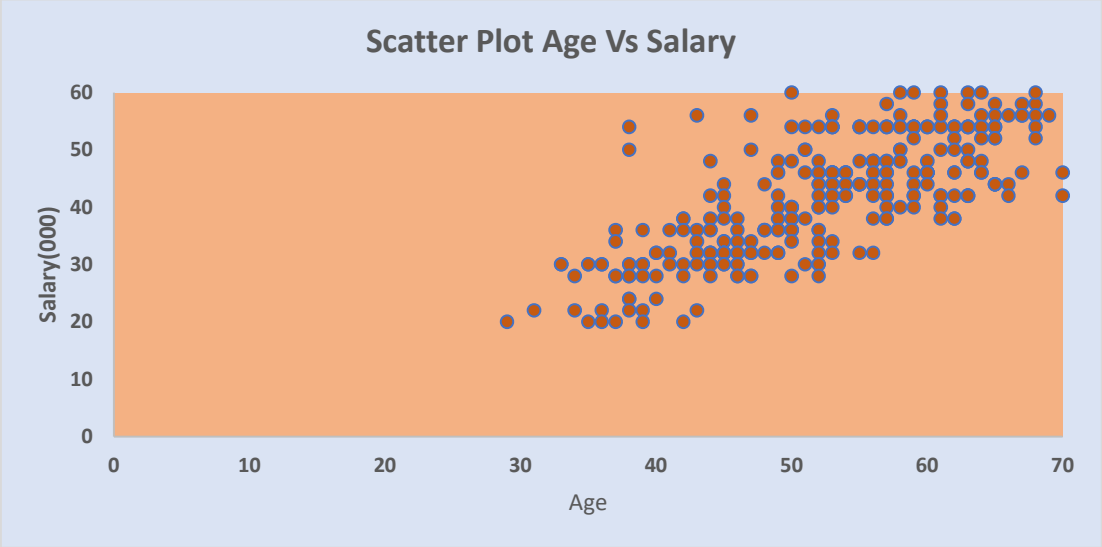
III. Test: Chi-Square Test (Two Categorical Variables)

E	F	G	H	I
Observed	**Expectation**	**O-E**	**(O-E)^2**	**((O-E)^2)/E**
39	35.34	3.66	13.40	0.38
54	57.66	-3.66	13.40	0.23
75	78.66	-3.66	13.40	0.17
132	128.34	3.66	13.40	0.10
			=Chi-Sq (cal)	0.8860
			=p-value	0.3465
			=Chi-Sq (tab)	3.8415

IV. The P-Value is 0.3465. The chosen of the level of significance is 0.05. Thus, the p-value is higher than the 0.05. Therefore, the result is not statistically significant at $p < 0.05$. Based on the above evidence, we cannot reject the null hypothesis and in favour of alternative hypothesis. On the other hand, the Chi-square calculated value (= 0.8860) is less than the Chi-square tabulated value (=3.8415), so we cannot reject the null hypothesis. Hence, there is no difference between the gender and promotion.

6. **Relationship between two numerical variables: does salary depend on age? (15 marks)**
   i. Create a scatter plot between Age and Salary and interpret the graphs (5 marks)
   ii. Run a regression of Salary on Age (5 marks)
   iii. Interpret the regression output (5 marks)

Answer (i): Simple scatter plot Age by Salary



ii. Regression Test Output:

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.7551					
R Square	0.5702					
Adjusted R Square	0.5688					
Standard Error	5.9928					
Observations	300					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	14198.8812	14198.8812	395.3584	0.0000	
Residual	298	10702.3555	35.9139			
Total	299	24901.2367				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	24.0706	1.4673	16.4045	0.0000	21.1830	26.9582
Age	0.6770	0.0340	19.8836	0.0000	0.6100	0.7440

(iii). Regression Equation:

$\widehat{Salary} = \beta_0 + \beta_1 * Age$

$\widehat{Salary} = 24.07 + 0.68 * Age$

Interpretation of the regression equation:

Intercept, $\beta_0 = 24.07$, the salary intercept implies that when the value of age is zero, then the mean value of salary is expected to increase by 24.07.

Slope, β_1= 0.68, the slope coefficient implies that for each increase of 1 year in age, then the value of salary is estimated to increase by 0.68. Additionally, the age variable is statistically significant at 5% level of significance.

Model Diagnose:

The R-square of the linear model is 0.57 (or 57%), it indicates that the 57% of the variation in the salary variable can be explained by the variation in the age variable. Thus, the model is moderately good fit with the data.

The p-value of the linear model is close to zero, which implies that it is less than the chosen level of significance (5%). Thus, the model is statistically significant.

7. **Relationship among many numerical variables: what determine the JSS after training? (15 marks)**
   i. Create 5 scatter plots between Job Satisfaction after Training and the 5 variables: OR, TW, INF, JP, and LWB respectively, and interpret the plots (5 marks)
   ii. Run a multiple regression to quantify the influences on the JSS (5 marks)
   iii. Interpret the regression output (5 marks)

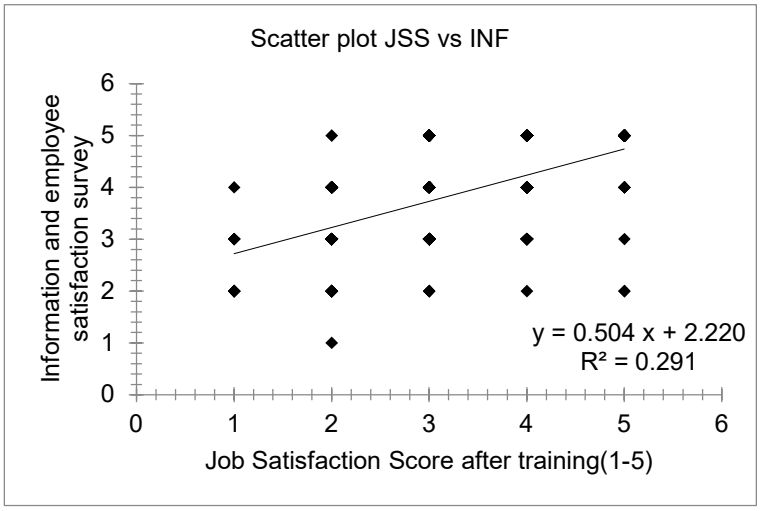
Answer (i) A) Scatter plots JSS vs OR

The scatter dots moving upward direction, indicates that there is a positive but weak correlation (i.e., 0.39) between the job satisfaction after training and organization relation and employee satisfaction.

B) Scatter plots JSS vs TW

The scatter dots moving upward direction, indicates that there is a positive but weak correlation (i.e., 0.40) between the job satisfaction after training & the teamwork and employee satisfaction.

C) Scatter plots JSS vs INF

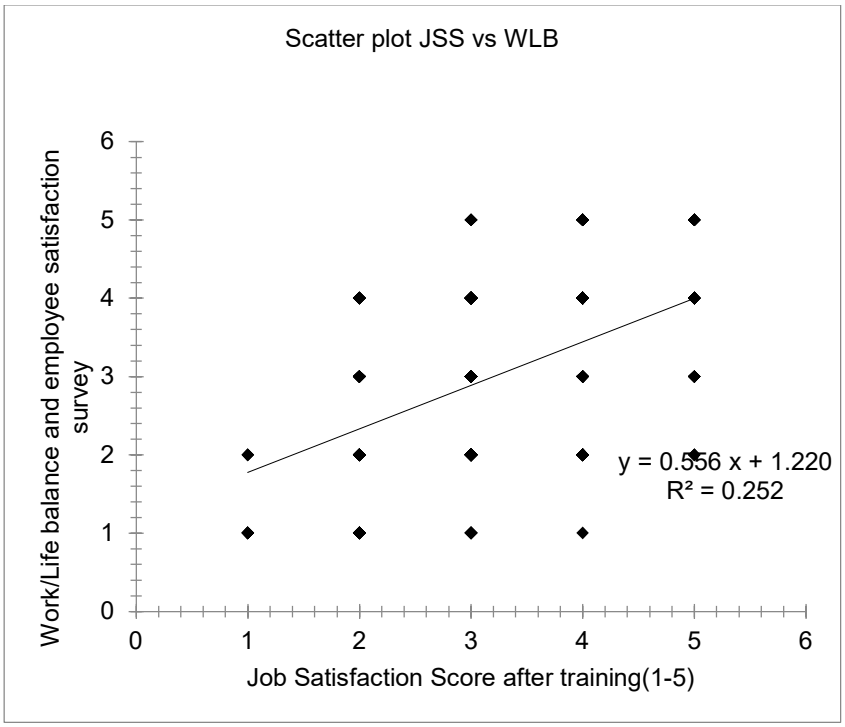


The scatter dots moving upward direction, indicates that there is a positive but moderately strong correlation (i.e., 0.54) between the job satisfaction after training & the information and employee satisfaction.

D) Scatter plots JSS vs JP

The scatter dots moving upward direction, indicates that there is a positive but moderately strong correlation (i.e., 0.50) between the job satisfaction after training & the Job passion and self-evaluation employee satisfaction.

E) Scatter plots JSS vs WLB



The scatter dots moving upward direction, indicates that there is a positive but moderately strong correlation (i.e., 0.502) between the job satisfaction after training & the work/Life balance and employee satisfaction.

(iii). Multiple regression Output:

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.7760					
R Square	0.6022					
Adjusted R Square	0.5954					
Standard Error	0.6342					
Observations	300					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	5	178.999	35.800	89.016	0.000	
Residual	294	118.238	0.402			
Total	299	297.237				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.8961	0.2081	-4.3063	0.0000	-1.3057	-0.4866
Organization relation and employee satisfaction survey	0.0737	0.0505	1.4609	0.1451	-0.0256	0.1731
Teamwork and employee satisfaction survey	0.3343	0.0392	8.5242	0.0000	0.2571	0.4115
Information and employee satisfaction survey	0.1859	0.0551	3.3749	0.0008	0.0775	0.2943
Job passion and self-evaluation employee satisfaction survey	0.3160	0.0411	7.6905	0.0000	0.2351	0.3968
Work/Life balance and employee satisfaction survey	0.3518	0.0350	10.0469	0.0000	0.2829	0.4207

Regression Equation:

$$\widehat{JSS} = \beta_0 + \beta_1 * OR + \beta_2 * TW + \beta_3 * INF + \beta_4 * JP + \beta_5 * WLB$$

$$\widehat{JSS} = -0.8961 + 0.07 * OR + 0.33 * TW + 0.19 * INF + 0.31 * JP + 0.35 * WLB$$

Interpretation of the multiple regression output:

- Slope, β_1= 0.07, the slope coefficient implies that for each increase of 1 good organization relation, then the value of JSS is estimated to increase by 0.07. Additionally, the OR variable is not significant at 5% level of significance.
- Slope, β_2= 0.33, the slope coefficient implies that for each increase of 1 good teamwork, then the value of JSS is estimated to increase by 0.33. Additionally, the TW variable is statistically significant at 5% level of significance.
- Similarly, we can interpret the rest of the beta coefficients.

Model Diagnose:

- The R-square of the linear model is 0.60 (or 57%), it indicates that the 60% of the variation in the JSS (dependent) variable can be explained by the variation all independent variable. Thus, the model is moderately good fit with the data.
- The p-value of the linear model is close to zero, which implies that it is less than the chosen level of significance (5%). Thus, the model is statistically significant.

Reference

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