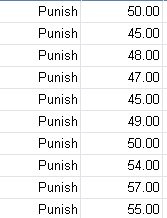
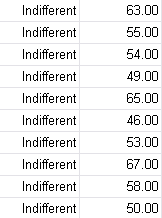
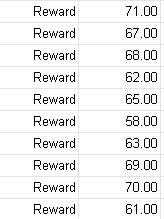
**SPSS Practical 9:**

**// one-way = one independent variable**

**Part A**

A professor is interested to know how different teaching methods affected students’ knowledge. Three different methods (punishment, indifferent, and reward) have been applied on three different groups of students and their exam scores are recorded as follow:

Carry out a One-way Independent ANOVA to test the hypotheses that:

// planeed comparison to test

1. reward results in better exam scores than either punishment or indifference

Normality test

: Normality can be assumed

: Normality can not be assume

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Tests of Normality** | | | | | | | |
|  | method | Kolmogorov-Smirnova | | | Shapiro-Wilk | | |
|  | Statistic | df | Sig. | Statistic | df | Sig. |
| score | Punish | .200 | 10 | .200\* | .929 | 10 | .437 |
| Indifferent | .156 | 10 | .200\* | .949 | 10 | .652 |
| Reward | .145 | 10 | .200\* | .956 | 10 | .741 |
| \*. This is a lower bound of the true significance. | | | | | | | |
| a. Lilliefors Significance Correction | | | | | | | |

K-S test(Punish)

D(10) = 0.200, sig = 0.200(> 0.05)

This is Non-SignificantConclusion : Punish is a normal distribution

K-S test(Indifferent)

D(10) = 0.156, sig = 0.200(> 0.05)

This is Non-SignificantConclusion : Indifferent is a normal distribution

K-S test(Reward)

D(10) = 0.145, sig = 0.200(> 0.05)

This is Non-SignificantConclusion : Reward is a normal distribution

// one way anova – Analyze -> compare -> one-way anova -> option -> 1,3,4,5 check

// homogeneity of variane 하면 anova, 아니면 robust

Homogeneity of variance test

Leven test

: Homogeneity can be assumed

: Homogeneity can not be assume

|  |  |  |  |
| --- | --- | --- | --- |
| **Test of Homogeneity of Variances** | | | |
| score | | | |
| Levene Statistic | df1 | df2 | Sig. |
| 2.569 | 2 | 27 | .095 |

F(2,27) = 2.569, sig = 0.095(> 0.05)

This is Non-Significant

Accept

Conclusion : Homogeneity of Variance can be Assumed

One-Way ANOVA Test

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ANOVA** | | | | | |
| score | | | | | |
|  | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 1205.067 | 2 | 602.533 | 21.008 | .000 |
| Within Groups | 774.400 | 27 | 28.681 |  |  |
| Total | 1979.467 | 29 |  |  |  |

Welch Test:

F(2,27) = 21.008, sig = 0.000(< 0.05)

This test is significant

Conclusion : At least two means are different

1. indifference will lead to significantly better exam scores than punishment

// planned comparisons, One-way ANOVA test -> contrast -> coefficients에 알맞은 값 넣기 (1 1 -2), (1 -1 0)

Plane Contrast test

|  |  |  |  |
| --- | --- | --- | --- |
| **Contrast Coefficients** | | | |
| Contrast | method | | |
| Punish | Indifferent | Reward |
| 1 | 1 | 1 | -2 |
| 2 | 1 | -1 | 0 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Contrast Tests** | | | | | | | |
|  |  | Contrast | Value of Contrast | Std. Error | t | df | Sig. (2-tailed) |
| score | Assume equal variances | 1 | -24.8000 | 4.14836 | -5.978 | 27 | .000 |
| 2 | -6.0000 | 2.39506 | -2.505 | 27 | .019 |
| Does not assume equal variances | 1 | -24.8000 | 3.76180 | -6.593 | 21.696 | .000 |
| 2 | -6.0000 | 2.59915 | -2.308 | 14.476 | .036 |

// contrast 2 부터

// 0.025 쓴건 2 – tail 때문에 어짜피 결과는 같게 나옴

**Contrast 2:**

Since sig = 0.019(<0.025)

This test is significant

Reject

Conclusion :

**Contrast 1:**

Since sig = 0.000 (< 0.025)

This test is significant

Reject

Conclusion :

Final Conclusion :

Planned contrasts revealed that reward(M=65.4, SE=1.36) produced significant better scores than punishment (M = 50, SE = 1.308) and indifference (M=56,SE = 2.246), t(27) = -5.978, p <0.025 and that punishment produced significantly worse scores than indifference, t(27) = -2.505, p<0.025

**Part B**

A medical doctor would like to know the effect of different drugs to a disease. The pain score for each drug is recorded as follows:



Carry out a One-way Independent ANOVA to test the effect of different drugs.

Normality test

: Normality can be assumed

: Normality can not be assume

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Tests of Normality** | | | | | | | |
|  | Drug | Kolmogorov-Smirnova | | | Shapiro-Wilk | | |
|  | Statistic | df | Sig. | Statistic | df | Sig. |
| Pain\_Score | Diclofenac | .169 | 8 | .200\* | .972 | 8 | .915 |
| Ibuprophen | .182 | 8 | .200\* | .962 | 8 | .825 |
| Paracetamol | .228 | 8 | .200\* | .864 | 8 | .131 |
| Asprin | .151 | 8 | .200\* | .977 | 8 | .946 |
| \*. This is a lower bound of the true significance. | | | | | | | |
| a. Lilliefors Significance Correction | | | | | | | |

K-S test(Diclofenac)

D(8) = 0.169, sig = 0.200(> 0.05)

This is Non-SignificantConclusion : Diclofenac is a normal distribution

K-S test(Ibuprophen)

D(8) = 0.182, sig = 0.200(> 0.05)

This is Non-SignificantConclusion : Ibuprophen is a normal distribution

K-S test(Paracetamol)

D(8) = 0.228, sig = 0.200(> 0.05)

This is Non-SignificantConclusion : Paracetamol is a normal distribution

K-S test(Asprin)

D(8) = 0.151, sig = 0.200(> 0.05)

This is Non-SignificantConclusion : Asprin is a normal distribution

Homogeneity of variance test

Leven test

: Homogeneity can be assumed

: Homogeneity can not be assume

|  |  |  |  |
| --- | --- | --- | --- |
| **Test of Homogeneity of Variances** | | | |
| Pain\_Score | | | |
| Levene Statistic | df1 | df2 | Sig. |
| 4.837 | 3 | 28 | .008 |

F(3,28) = 4.837, sig = 0.008(< 0.05)

This is Significant

Reject

Conclusion : Homogeneity of Variance can not be Assumed

Rodust Tests of Equality of Means

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Robust Tests of Equality of Means** | | | | |
| Pain\_Score | | | | |
|  | Statistica | df1 | df2 | Sig. |
| Welch | 32.064 | 3 | 12.171 | .000 |
| Brown-Forsythe | 11.967 | 3 | 18.889 | .000 |
| a. Asymptotically F distributed. | | | | |

F(3,12.171) = 32.064, sig = 0.000(< 0.05)

This test is significant

Conclusion : At least two means are different

// plane contrast 따로 언급 없었으므로 안됨

// one way anova -> post hoc ->

Post Hoc Test(Games-Howell)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Multiple Comparisons** | | | | | | |
| Dependent Variable: Pain\_Score | | | | | | |
| Games-Howell | | | | | | |
| (I) Drug | (J) Drug | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
| Lower Bound | Upper Bound |
| Diclofenac | Ibuprophen | -8.750 | 6.176 | .513 | -27.05 | 9.55 |
| Paracetamol | -9.500 | 7.548 | .602 | -31.45 | 12.45 |
| Asprin | -33.500\* | 5.194 | .001 | -50.55 | -16.45 |
| Ibuprophen | Diclofenac | 8.750 | 6.176 | .513 | -9.55 | 27.05 |
| Paracetamol | -.750 | 6.485 | .999 | -20.09 | 18.59 |
| Asprin | -24.750\* | 3.471 | .001 | -36.03 | -13.47 |
| Paracetamol | Diclofenac | 9.500 | 7.548 | .602 | -12.45 | 31.45 |
| Ibuprophen | .750 | 6.485 | .999 | -18.59 | 20.09 |
| Asprin | -24.000\* | 5.558 | .014 | -42.26 | -5.74 |
| Asprin | Diclofenac | 33.500\* | 5.194 | .001 | 16.45 | 50.55 |
| Ibuprophen | 24.750\* | 3.471 | .001 | 13.47 | 36.03 |
| Paracetamol | 24.000\* | 5.558 | .014 | 5.74 | 42.26 |
| \*. The mean difference is significant at the 0.05 level. | | | | | | |

Comparison 1:

Since sig = 0.513(> 0.05)

This test is Non-Significant

Accept

Conclusion

Comparison 2:

Since sig = 0.602(> 0.05)

This test is Non-Significant

Accept

Conclusion

Comparison 3:

Since sig = 0.001(< 0.05)

This test is Significant

Reject

Conclusion

The effect of Diclofenac (M = 22.63,SE = 5.151), Ibuprophen (M = 31.38 , SE=3.407)

And Paracetamol (M=32.13, SE=5.518) is about the same, but significantly different from Aspirin (M=56.13,SE = 0.666), F(3,12.171)= 32.064,p<0.05