GREAT LAKES
INSTITUTE OF MANAGEMENT, CHENNAI

TITAN INSURANCE
A GROUP ASSIGNMENT

GROUP 1 – CHN-BABI-JAN2017

Abishek | K S Suraj | Mithran | Suryaprakash | Santhosh

THE HYPOTHESIS

There are 2 Schemes, One is Old Scheme and Other is New Scheme. If the Average Sales of the Scheme is better than the old scheme, Firm will continue with New scheme, else status quo. [There is a breakeven expected in 6 months to count for success]

NULL HYPOTESIS – H_0	Average Sales of Old Scheme is same as Average Sales of New Scheme i.e., $\mu_0 = \mu_1$
ALTERNATE HYPOTHESIS - H_A	Average Sales of New Scheme is greater than Average Sales of Old Scheme

DATA

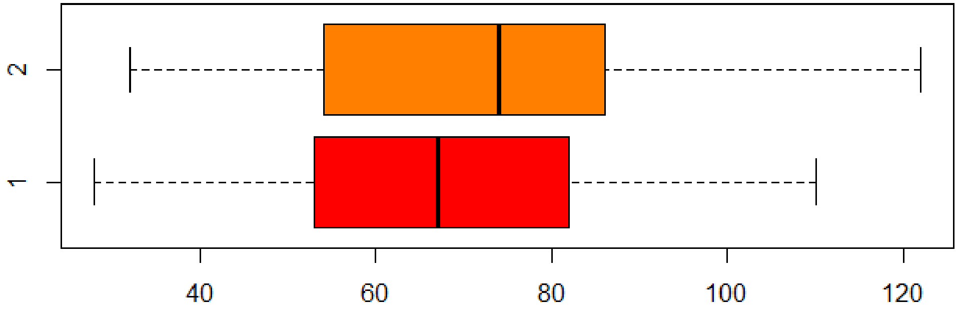
Sales.Person	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Old.Scheme	57	103	59	75	84	73	35	110	44	82	67	64	78	53	41	39	80	87	73	65	28	62	49	84	63	77	67	101	91	50
New.Scheme	62	122	54	82	84	86	32	104	38	107	84	85	99	39	34	58	73	53	66	78	41	71	38	95	81	58	75	94	100	68

Exploratory Analysis

Old Scheme	
Mean	68.03333333
Standard Error	3.734733933
Median	67
Mode	84
Standard Deviation	20.45598021
Sample Variance	418.4471264
Kurtosis	-0.419684789
Skewness	0.040164666
Range	82
Minimum	28
Maximum	110
Sum	2041
Count	30
Confidence Level(95.0%)	7.638388545

New Schme	
Mean	72.03333333
Standard Error	4.393172167
Median	74
Mode	84
Standard Deviation	24.06239495
Sample Variance	578.9988506
Kurtosis	-0.76387692
Skewness	-0.023559279
Range	90
Minimum	32
Maximum	122
Sum	2161
Count	30
Confidence Level(95.0%)	8.985045938

Box Plot



- No Outliers
- New Scheme is little Skewed towards right with in IQR

IDENTIFY THE HYPOTHESIS AND TEST STATISTIC

Mean of S1 (Old Scheme) : $\mu_0 = 68.03333333$

Mean of S2 (new Scheme) : $\mu_1 = 72.03333333$

Difference = 4, prove alternate hypothesis.

What test statistic to be used?

As the Sample is Size is 30, We will use paired t test statistic

$T = \frac{\overline{D}}{S/\sqrt{n}}$, Where, D= $X_1 - X_2$

QUESTION 1 – SIGNIFICANT TEST

From the problem, we understand that, significance of the test depends on 2 sample data sets, old and new schemes. The question is to determine whether new scheme has significantly raised outputs. Significant levels is set as 5%, or Zstat as -1.64485.

$\overline{D} = X_1 - X_2$

X_1 = 68.03333333 | X_2 = 72.0333333 | $\overline{D}$ = 4

$S/\sqrt{n}$ = 2.571

T = -1.55591

QUESTION 1 & 2 – SIGNIFICANT TEST

From the problem, we understand that, significance of the test depends on 2 sample data sets, old and new schemes. The question is to determine whether new scheme has significantly raised outputs. Significant levels is set as 5%, or Zstat as -1.64485.

$\overline{D} = X_1 - X_2$

X_1 = 68.03333333 | X_2 = 72.0333333 | $\overline{D}$ = 4

$S/\sqrt{n}$ = 2.571

T = -1.55591

5% of Significant level is expected, Alternatively, we can also say, 95% of Confidence level is expected

P-val = 0.06529 , 6% of significant level, alternatively , This implies that there is no significant increase in the average output after implementation of the new scheme. **Hence the Titan Insurance company can stick to the older scheme which would be less expensive than the new scheme.**

QUESTION 1 & 2 – SIGNIFICANT TEST – R & EXCEL PROOF

R

```
        Paired t-test

data:  Old.Scheme and New.Scheme
t = -1.5559, df = 29, p-value = 0.06529
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
      -Inf 0.3681762
sample estimates:
mean of the differences
                     -4
```

Excel

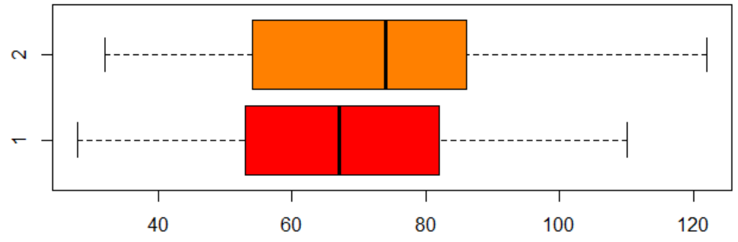
t-Test: Paired Two Sample for Means		
	Variable 1	*Variable 2*
Mean	68.03333333	72.03333333
Variance	418.4471264	578.9988506
Observations	30	30
Pearson Correlation	0.811801957	
Hypothesized Mean Difference	0	
df	29	
t Stat	-1.555914382	
P(T<=t) one-tail	0.06528777	
t Critical one-tail	1.699127027	
P(T<=t) two-tail	0.13057554	
t Critical two-tail	2.045229642	

QUESTION 3 - RESERVATIONS

Taking advantage if Central Limit Theorem, we Assume Population is Distributed Normally.

Coefficient Variable of New Scheme is 33% versus old Scheme which is 30%, that says, More risk is involved in New Scheme

Both the samples are random continuous Variable



Observations are mutually independent to each other.

Population Size or Population mean is not given.

Looking at the box-plot, we can infer there are no outliers.

New Scheme is little Skewed towards right with in IQR

QUESTION - 4

Suppose it has been calculated that in order for Titan to break even, the average output must increase by £5000. If this figure is alternative hypothesis, what is:

(i) The probability of a type 1 error?

(ii) The probability of a type 2 error?

(iii)The power of the test?

QUESTION – 4 : THE PROBABILITY OF A TYPE 1 ERROR

From the previous discussion and generally accepted criteria for Type I error being 5%, here also it is same 5%

QUESTION – 4 : THE PROBABILITY OF A TYPE 2 ERROR & POWER OF TEST

To Find Power of Test

Step 1 : Find the Standard Deviation of Samples

S1 – Standard Deviation of Old Scheme = 20.46

S2 - Standard Deviation of New Scheme = 24.06

R

```
> S1 = sd(Old.Scheme)
> S1
[1] 20.45598
> S2 = sd(New.Scheme)
> S2
[1] 24.06239
```

QUESTION – 4 : THE PROBABILITY OF A TYPE 2 ERROR & POWER OF TEST

Step 2 : Calculate Combined Standard Deviation or Pooled Standard Deviation

$$Pooled\ Standard\ Deviation = \sqrt{\left((S_1^2 + S_2^2)/2\right)}$$

R

```
> PooledStdev = sqrt((S1^2 + S2^2)/2)
> PooledStdev
[1] 22.33211
```

QUESTION – 4 : THE PROBABILITY OF A TYPE 2 ERROR & POWER OF TEST

Step 3 : To Calculate β (Power)

Stated : Average mean has to be increased by $5000 in the new scheme to achieve breakeven, So $5000 needs to be added to $4000(mean diff of existing sample)

R

```
> Power.of.Test.5000 = power.t.test(n=30,delta=9,sd=PooledStdev,power = NULL,sig.level = 0.05, type="two.sample", alternative = "one.sided")
> Power.of.Test.5000

     Two-sample t test power calculation 

              n = 30
          delta = 9
             sd = 22.33211
      sig.level = 0.05
          power = 0.4592797
    alternative = one.sided
```

QUESTION – 4 : THE PROBABILITY OF A TYPE 2 ERROR & POWER OF TEST

To Find Type II Error (β)

Power (POT) = 0.4592797

1 - 0.4592797 = 0.5407203

β = **0.5407203**

Actually,
Power Of Test (POT) = 1 - β
POT = 1 - β
1- β =POT
-β = POT-1
β = -POT+1
β = 1-POT

QUESTION – 5 :
SAMPLE SIZE THAT MAKES THE PROBABILITIES OF TYPE I AND TYPE II ERRORS EQUAL

R Code

```
> power.t.test(n=NULL,delta = 9,sd = PooledStdev,power = 0.95,sig.level = 0.05, type = "two.sample" ,alternative = "one.sided")

     Two-sample t test power calculation

              n = 133.948
          delta = 9
             sd = 22.33211
      sig.level = 0.05
          power = 0.95
    alternative = one.sided

NOTE: n is number in *each* group
```

We Need 133.948, or 134 samples approximately that will make the probabilities of TYPE I error and TYPE II errors Equal

THANK YOU