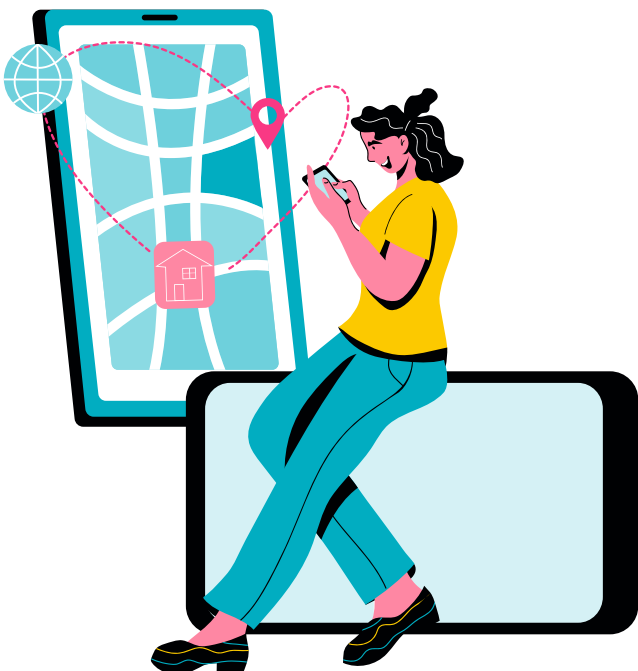


CBC ANALYSIS

“
THE BEST MOBILE
PHONE PACKAGE FOR
LUMS STUDENTS
”



GROUP 2

MALIK M. MUSSAB
RUBAB MUKHTAR
NAMRA ASGHAR
ABRAR ALI

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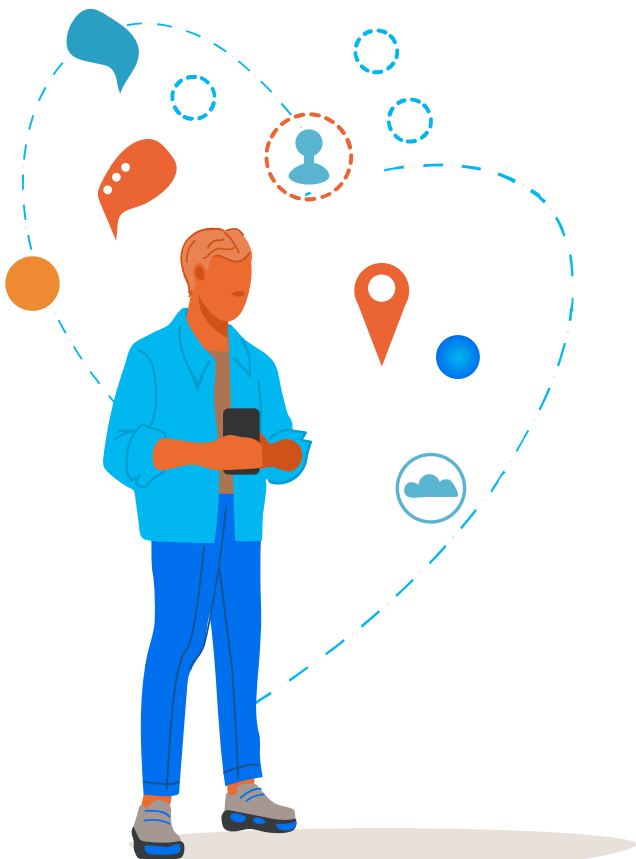
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CHOSEN PRODUCT

Following the demands of the 21st century, a century driven by market and technology, we identified that one of the primary requirements that anyone today has is conveniently related to mobile phones. This offers us multiple pathways, we could explore the type of mobile phones that could be introduced, its specifications etc, however, we chose to delve into an idea different from these.

The plan, thus, is to introduce a

mobile phone package.

Our package is meant to specifically target the needs of students that go to the Lahore University of Management Sciences (here on referred to as LUMS). Packages introduced to students are usually subscription-based, offering little versatility in terms of identifying their needs. We, being students ourselves, realized our needs and thus, put forth a survey to ask more of our fellows about what package suits them best.

The attributes and subsequent levels were chosen via an internet search and an informal question-answer session with students around campus. For any service providing company, the primary focus is the internet, off-net and on-net minutes and pricing. Their payment plan often follows whatever they find most convenient following their routines. To exemplify, a business associate would prefer a post-paid package while a student may dwell between subscription and pre-paid based on their needs. SMS, oftentimes, is considered an important level when considering the design of packages, but in our context, most of the students at LUMS make little to no use of SMS as WhatsApp conveniently removes its need, which is why we have not made use of it.

ATTRIBUTES & LEVELS

Payment Type

- Subscription

Billing is done in reference to whatever service is subscribed to before one begins to use it.

- Post Paid

Billing is done after the end of 30 days

- Pre Paid

Billing is done before the month begins

On-Net Minutes per Month

Calls between users of the same service provider

- 40
- 60
- 80
- 100

Off-Net Minutes per Month

Calls between users of different service providers

- 40
- 60
- 80
- 100

Internet GBs per Month

- 5
- 10
- 15
- 20
- 25

Pricing per Month

- 300
- 500
- 700
- 900

SURVEY DESIGN

The survey was designed using the Sawtooth Software, where a choice-based conjoint choice survey was created. The first 10 questions were created in order to understand and judge our target audience. We were aiming to determine their lifestyle and categorize their mobile phone use based on descriptive indicators. Following is the list of these indicators and their subsequent options.

1. Gender: The descriptor Gender was added to gauge the similarities and differences, if any, between the package-choices different genders make.

2. Age: With age, mobile phone usage, the purpose of usage, affordability, and overall preferences may change. For instance, as a person enters the 20+ age bracket, their responsibilities may increase. Therefore, adding the Age descriptor to the survey helped us determine the relationships between age groups and their subsequent package needs.

3. University Year: As we are targeting the LUMS Student body, it is evident that the workload throughout the university years varies. For instance, Junior and Senior students may also be serving as Teaching Assistants, Research assistants, or Interns which may affect their choice of package.

4. Employment Status: As aforementioned, with greater responsibilities comes greater, or varying mobile phone usage. Therefore, it was important to ascertain the employment status of the students in order to understand their choices.

5. Living Status: Students at LUMS either live on campus at hostels, off-campus at hostels, or with their parents at home. Accordingly, as their independence varies so does their mobile phone package usage. A student who resides independently is expected to have greater usage.

6. Average Household Income: This descriptor can be taken as a constraint on the level of spending that the students are willing to undertake. Therefore, it was important to include this in the survey so that a relationship between the package they chose and their income can be taken into account.

7. Location (Province): This descriptor helps in assessing whether the use of cell phone packages differs because of the location.

8. Times travel per year: This will allow us to gauge what travellers of different frequencies prefer with their telephone package.

9. Purpose of using a mobile phone: Depending on how students make use of their mobile phone, it will be easier to determine which attributes and what levels of those attributes will suit them best.

10. Mobile phone price: Depending on their affordability and how much they invest in technology, this descriptor will help determine what package suits their needs best according to their investing habits.

CBC choices (15)

Via the use of Sawtooth Software's CBC option, the attributes and their levels were used to create 60 options for the students to choose from. This way their most preferred package will be selected and will thus help us find the optimal combination for a package. It will include a number of variations with each of the chosen levels of attributes. The choices will thus include 5 levels, each corresponding to Payment Type, On-Net minutes, Off-Net minutes, GBs per month and Pricing per month.

MODEL EQUATION

Multinomial Logit Model

Package Value = f(Payment Type, On Net Mins, Off Net Mins, Internet GBs, Price)

Assumption: there is a linear combination amongst the attributes

Independent Variables

- Postpaid
- Subscription
- 60 On-Net Mins
- 80 On-Net Mins
- 100 On-Net Mins
- 60 Off-Net Mins
- 80 Off-Net Mins
- 100 Off-Net Mins
- 10GBs
- 15GBs
- 20GBs
- 25GBs
- Price

Dependent Variables

- Choice

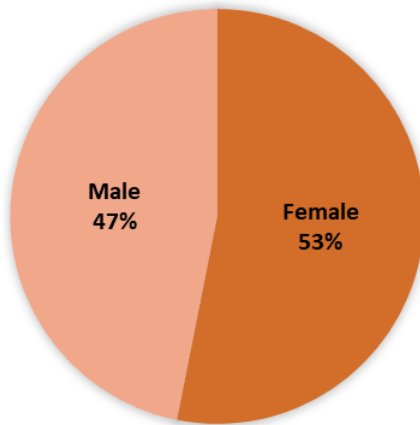
$$V = \beta_1(\text{postpaid}) + \beta_2(\text{subscription}) + \beta_3(\text{On Net 60}) + \beta_4(\text{On Net 80}) + \beta_5(\text{On Net 100}) \\ + \beta_6(\text{Off Net 60}) + \beta_7(\text{Off Net 80}) + \beta_8(\text{Off Net 100}) + \beta_9(\text{GBs 10}) \\ + \beta_{10}(\text{GBs 15}) + \beta_{11}(\text{GBs 20}) + \beta_{12}(\text{GBs 25}) + \beta_{13}(\text{Price})$$

Base categories

- Payment Type: Prepaid
- On-Net Mins: 40
- Off-Net Mins: 40
- Internet GBs: 5

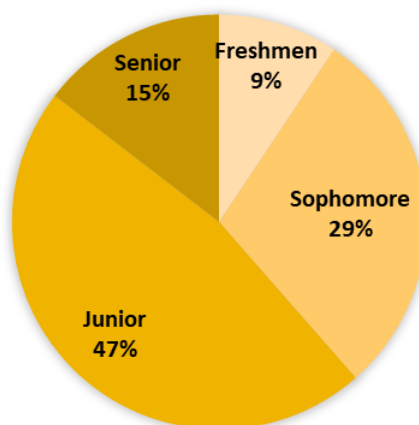
SAMPLE DESCRIPTION

Gender



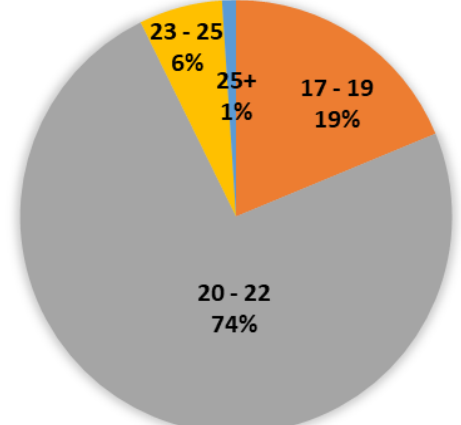
- 45 of the respondents were males, while 51 were females

University Year



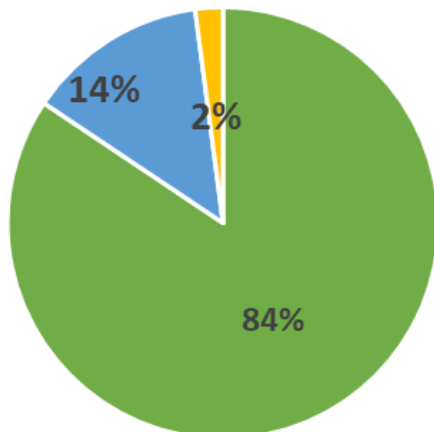
- 45 respondents were Juniors and 28, sophomores

Age Group



- 71 of the respondents belonged to the 20-22 age group

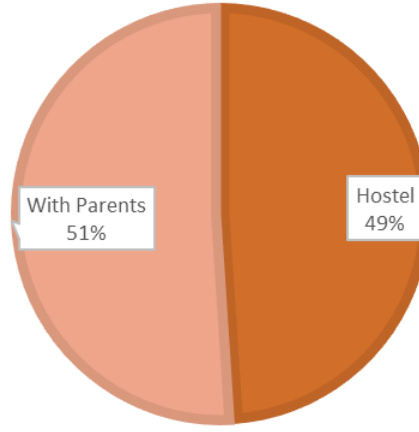
Employment Status



■ Student ■ Part Time ■ Full Time

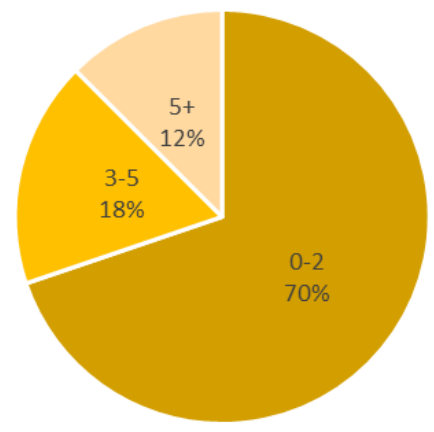
- 81 respondents were students

Living Status



- 49 students lived with their parents, 41 in hostel

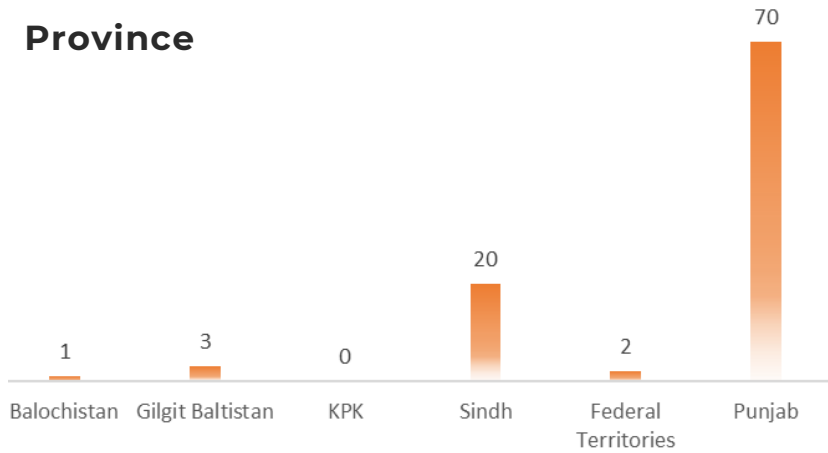
Travel per year



-67 respondents travel fewer than 2 times a year.

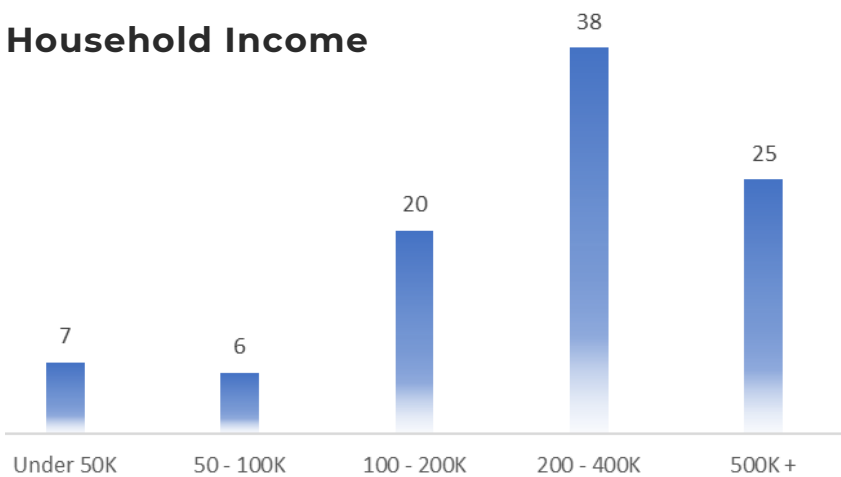
SAMPLE DESCRIPTION

Province



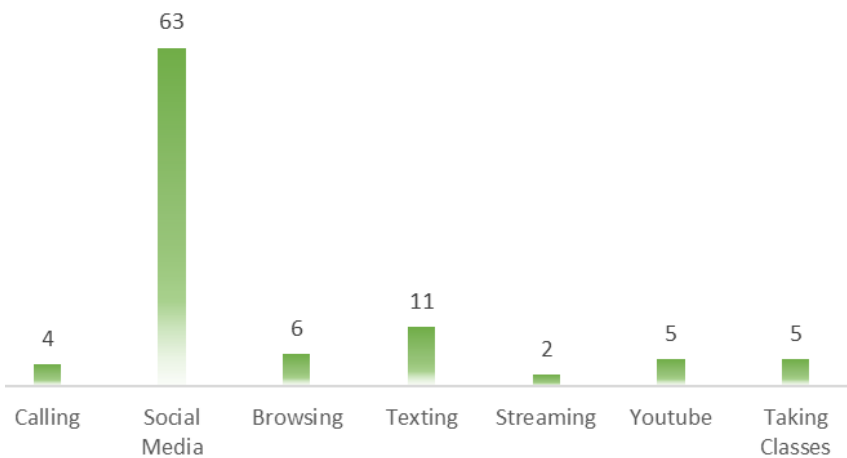
- 70 respondents belonged to Punjab and 20 to Sindh

Household Income



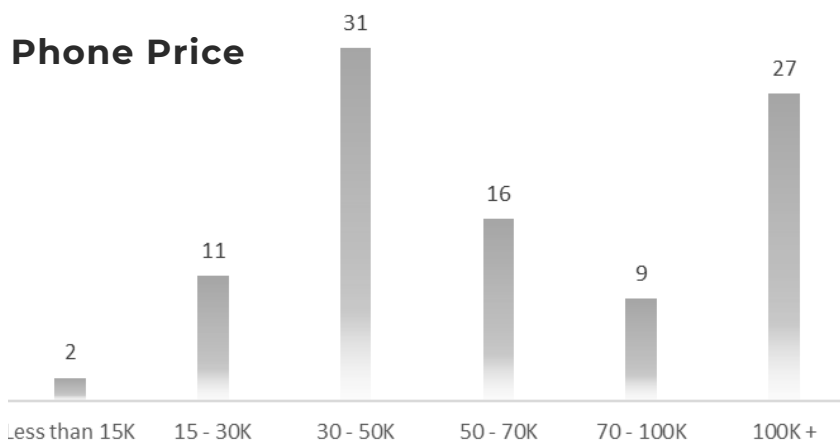
- 38 respondents have income between 200 - 400K.

Purpose of using Mobile Phone



- 63 students use their phones for social media.

Phone Price



- 31 students have mobiles in the range of 30 - 50K.

MODEL RESULTS

$$V = -0.009 (\text{Postpaid}) - 0.152 (\text{Subscription}) + 0.187 (60 \text{ On} - \text{Net Mins}) + 0.172 (80 \text{ On} - \text{Net Mins}) + 0.261 (100 \text{ On} - \text{Net Mins}) + 0.111 (60 \text{ Off} - \text{Net Mins}) + 0.119 (80 \text{ Off} - \text{Net Mins}) + 0.322 (100 \text{ Off} - \text{Net Mins}) + 0.506 (10 \text{ GBs}) + 0.864 (15 \text{ GBs}) + 1.183 (20 \text{ GBs}) - 0.661 (25 \text{ GBs}) - 0.002 (\text{Price})$$

Attribute	Coefficients
Payment Type Postpaid	-0.009120052
Payment Type Subscription	-0.152371280
60 On Net Mins Per Month	0.187036282
80 On Net Mins Per Month	0.172442613
100 On Net Mins Per Month	0.260988324
60 Off Net Mins Per Month	0.110873522
80 Off Net Mins Per Month	0.118817783
100 Off Net Mins Per Month	0.322567419
10 GBs per month	0.505704847
15 GBs per month	0.863958156
20 GBs per month	1.183027592
25 GBs per month	-0.661446287
Price (PKR)	-0.002240135

Attribute	Coefficient Sign	Pr(> z)	Significance (0.05)
Postpaid Payment Type	Negative	0.9161939	(Insignificant)
Subscription Payment Type	Negative	0.0809509	. (Insignificant)
60 On Net Mins Per Month	Positive	0.0481724	* (Significant)
80 On Net Mins Per Month	Positive	0.0683219	. (Insignificant)
100 On Net Mins Per Month	Positive	0.0054678	** (Significant)
60 Off Net Mins Per Month	Positive	0.2441283	(Insignificant)
80 Off Net Mins Per Month	Positive	0.2082768	(Insignificant)
100 Off Net Mins Per Month	Positive	0.0004845	*** (Significant)
10 GBs per month	Positive	7.505e-06	*** (Significant)
15 GBs per month	Positive	1.998e-15	*** (Significant)
20 GBs per month	Positive	< 2.2e-16	*** (Significant)
25 GBs per month	Negative	2.183e-06	*** (Significant)
Price (PKR)	Negative	< 2.2e-16	*** (Significant)

The following attribute levels are found to be **insignificant** in the logit model and hence no statistical interpretations can be made for them:

- Postpaid Payment Type
- Subscription Payment Type
- 80 On Net Mins Per Month
- 60 Off Net Mins Per Month
- 80 Off Net Mins Per Month

The following attribute levels are found to be **significant** in the logit model and hence can be interpreted statistically:

On-Net Mins

- The preference for 60 on-net mins is greater than that of 40 on-net mins.
- The preference for 100 on-net mins is greater than that of 40 on-net mins.
- Customers' preference for 60 on-net mins over 40 on-net mins is slightly weaker than their preference for 100 on-net mins over 40 on-net mins.

Off-Net Mins

- The preference for 100 off-net mins is greater than that of 40 off-net mins.

Internet GBs

- The preference for 10GBs internet is greater than that of 5GBs internet.
- The preference for 15GBs internet is greater than that of 5GBs internet.
- The preference for 20GBs internet is greater than that of 5GBs internet.
- Customers' preference for 20GBs internet per month over 5GBs is much stronger than their preferences for 10GBs over 5GBs and 15GBs over 5GBs.
- The preference for 25GBs internet is lesser than that of 5GBs internet.

Prices

- Customers' spending willingness (price) coefficient is negative which means they prefer lower prices.
- This was also evident from the xtabs test which categorized the respondents price preference:
479 times respondents chose a package priced at Rs.300 per month
345 times respondents chose a package priced at Rs.500 per month
242 times respondents chose a package priced at Rs.700 per month
149 times respondents chose a package priced at Rs.900 per month

As price increases, the chances that the package is chosen go down. There is a negative relationship between price and choice of package

WILLINGNESS TO PAY FOR EACH ATTRIBUTE

This was interpreted by dividing all the logit model attribute coefficients by the price willingness coefficient resulting in values in Rs. terms.

Payment Type

- Postpaid payment type is worth Rs. 4.07 less than Prepaid.
- Subscription payment type is worth Rs. 68.02 less than Prepaid.

On-Net Mins

- 60 On-Net Mins Per Month are worth Rs.83.49 more than 40 On-Net Mins Per Month.
- 80 On-Net Mins Per Month are worth Rs.76.98 more than 40 On-Net Mins Per Month.
- 100 On-Net Mins Per Month are worth Rs.116.51 more than 40 On-Net Mins Per Month.

Off-Net Mins

- 60 Off-Net Mins Per Month are worth Rs.49.49 more than 40 Off-Net Mins Per Month
- 80 Off-Net Mins Per Month are worth Rs.53.04 more than 40 Off-Net Mins Per Month
- 100 Off-Net Mins Per Month are worth Rs.143.99 more than 40 Off-Net Mins Per Month

Internet GBs

- 10 GBs Internet per month is worth Rs. 225.75 more than 5 GBs Internet per month.
- 15 GBs Internet per month is worth Rs. 385.67 more than 5 GBs Internet per month.
- 20 GBs Internet per month is worth Rs. 528.11 more than 5 GBs Internet per month.
- 25 GBs Internet per month is worth Rs. 295.27 less than 5 GBs Internet per month.

BEST CONFIGURATION OF THE PRODUCT

Attribute	Level
Payment Type	Prepaid
On-Net Mins	100
Off-Net Mins	100
Internet GBs	25
Price	900

CUSTOMER SEGEMENTATION

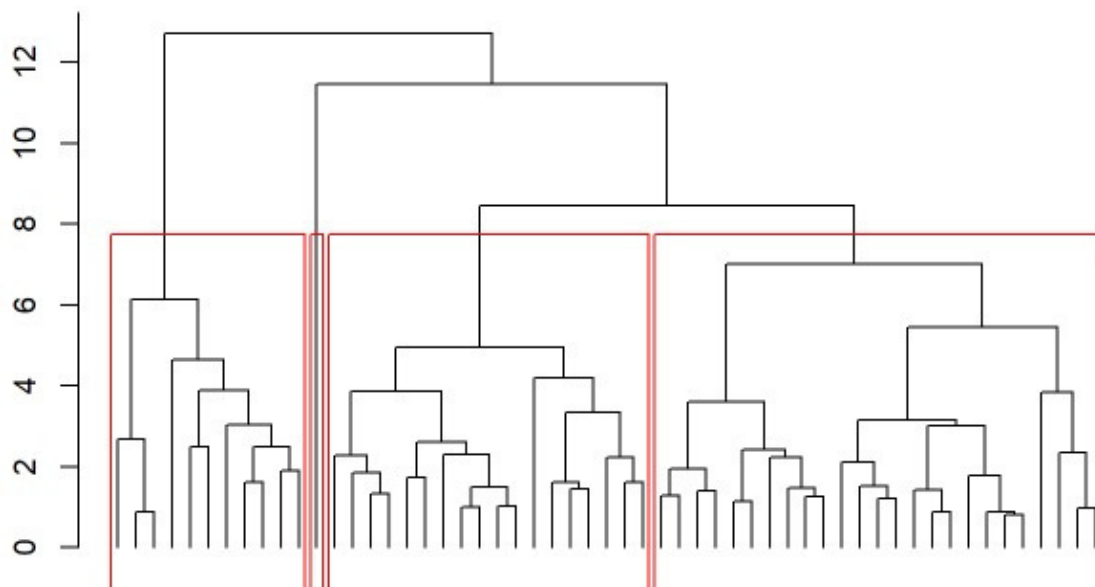
The customers are segmented according to their needs and how important they ranked the purpose they use their mobile phone for. A google form was circulated amongst the LUMS student body and 55 responses were taken into account. The responses were scaled out of 10 and a cluster dendrogram was made. By the use of the hclust function that 55 respondents were segmented into 4 clusters so as to ensure that the loss of data was kept as minimal as was possible. A cluster group was extracted and the respondents falling into each segment were identified.

1	2	3	4
11	25	18	1

After this, the aggregates for each cluster were listed based on the average of what each of them deemed most important. The following summarizes the aggregate data.

Group	Calls	Social Media	Internet	Text	Stream	Youtube	Attend classes
1	6.363636	8.272727	8.090909	4.272727	5.636364	5.909091	3.454545
2	2.920000	7.840000	8.160000	4.560000	8.320000	8.280000	8.400000
3	7.777778	7.222222	7.944444	5.277778	8.000000	8.722222	7.666667
4	2.000000	76.00000	4.000000	1.000000	8.000000	8.000000	7.000000

The analysis of these results helps us understand that Group 1, for instance, rates the use of social media as the highest (8.28), while taking classes is the lowest (3.45). However, their use of the rest comes pretty close, thus, if this group was to be targeted then a package that offered optimal options for all the attributes would be better suited. On the other hand, however, Group 4 places the most priority on social media (76.0) and the least on texting (1.0). It necessarily follows that targeting this segment would require optimal packages with a focus on Internet GBs per month.



APPENDIX

Sawtooth Survey

<https://dsc25050.sawtoothsoftware.com/Tc2cnGpZ3j/cgi-bin/ciwwweb.pl?studyname=Tc2cnGpZ3j>

Google Form

https://docs.google.com/forms/d/e/1FAIpQLScoz--EuBQsZ5ks7jD_JqLPUswwbaA5KI_4CkQy_ywv-2n_jLA/viewform?usp=sf_link

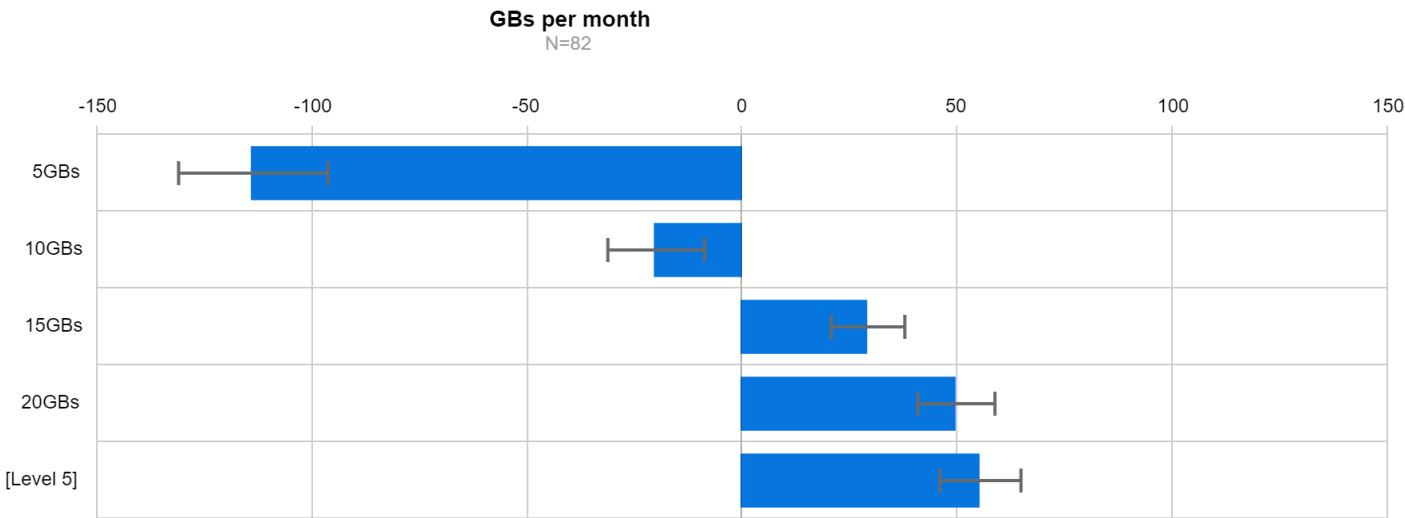
Descriptive Indicators Data

<https://docs.google.com/spreadsheets/d/1tFngTYnBKJ80jHWWA8IQ9P9TLiOEXAfUUC6H7VrnhOE/edit#gid=111810561>

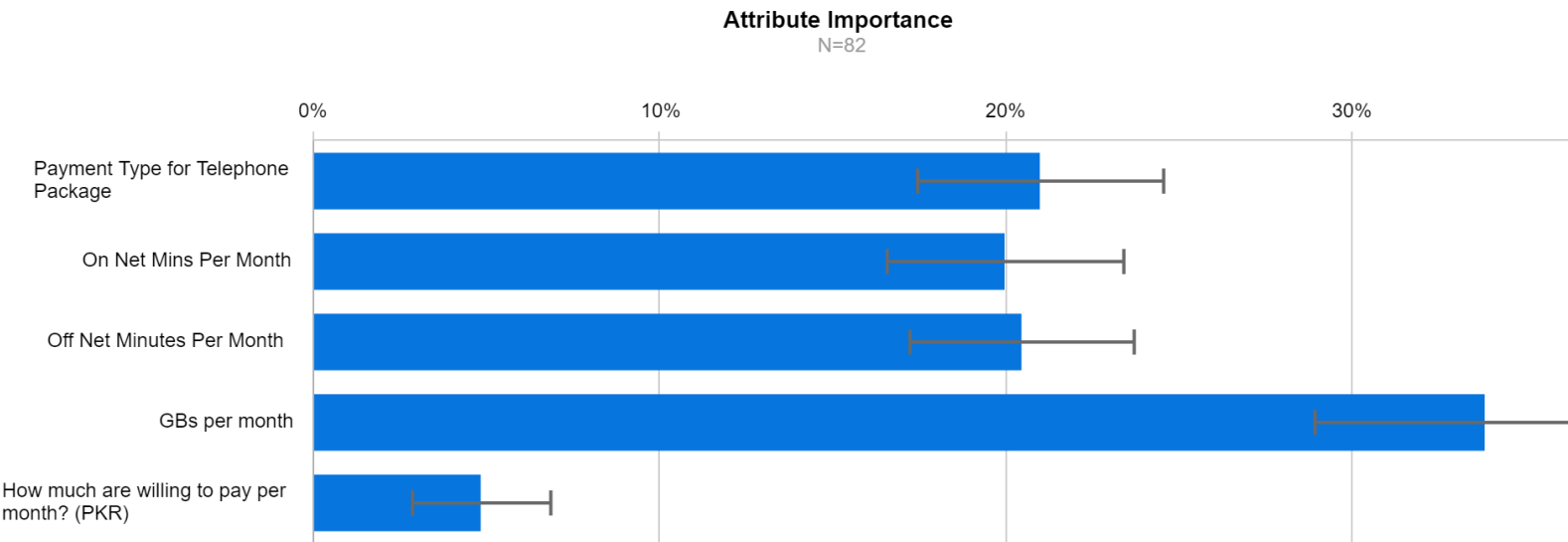
Attributes Dataset

https://docs.google.com/spreadsheets/d/1zfSSlvpM5-LESYXLX9kp_YptngM_UEa-11q7zyndPpl/edit#gid=0

UTILITY CHARTS

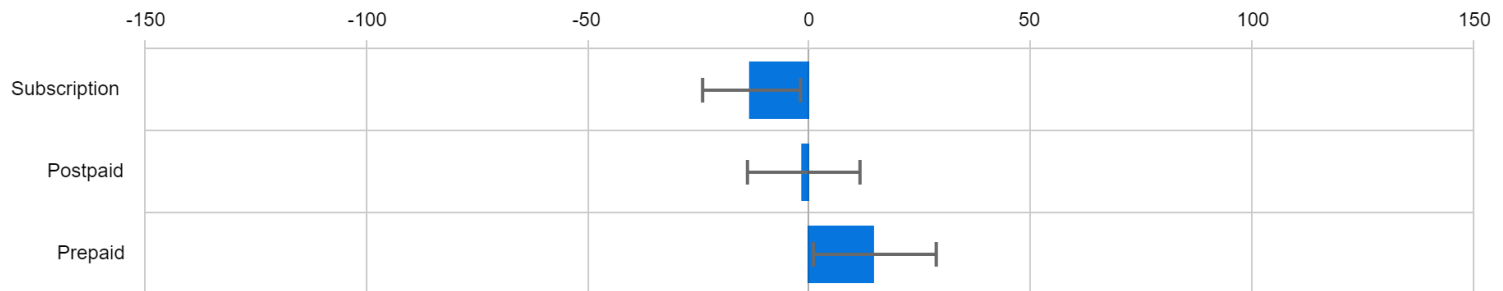


Utility Chart 1: GBs per Month



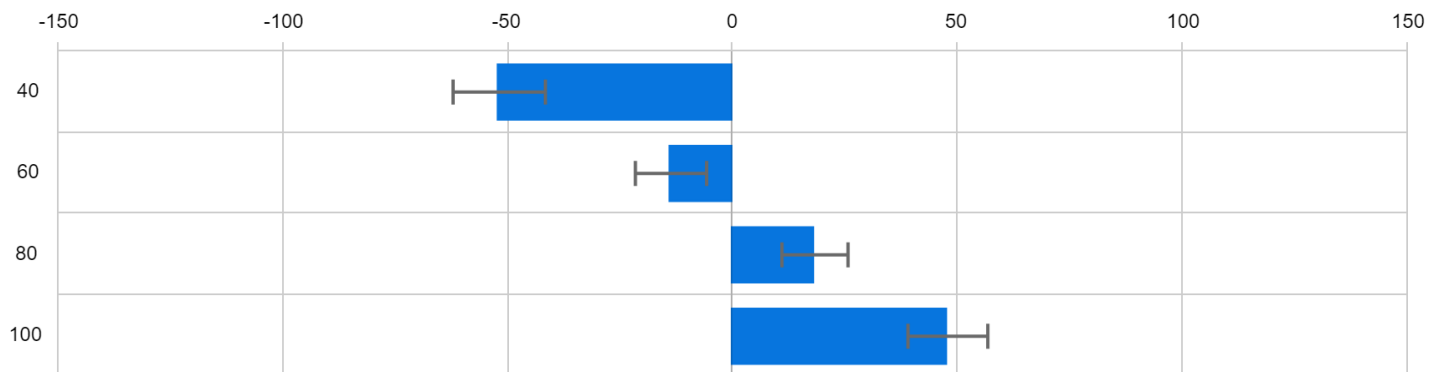
Utility chart 2: Attribute Importance

Payment Type for Telephone Package
N=82



Utility Chart 3: Payment Type

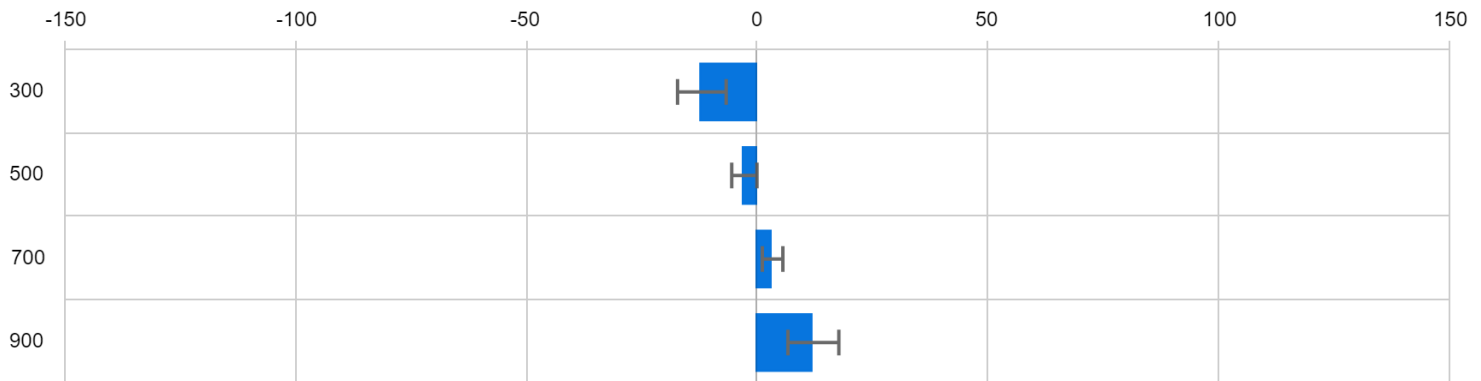
On Net Mins Per Month
N=82



Utility chart 4: On-Net Minutes per Month

How much are willing to pay per month? (PKR)

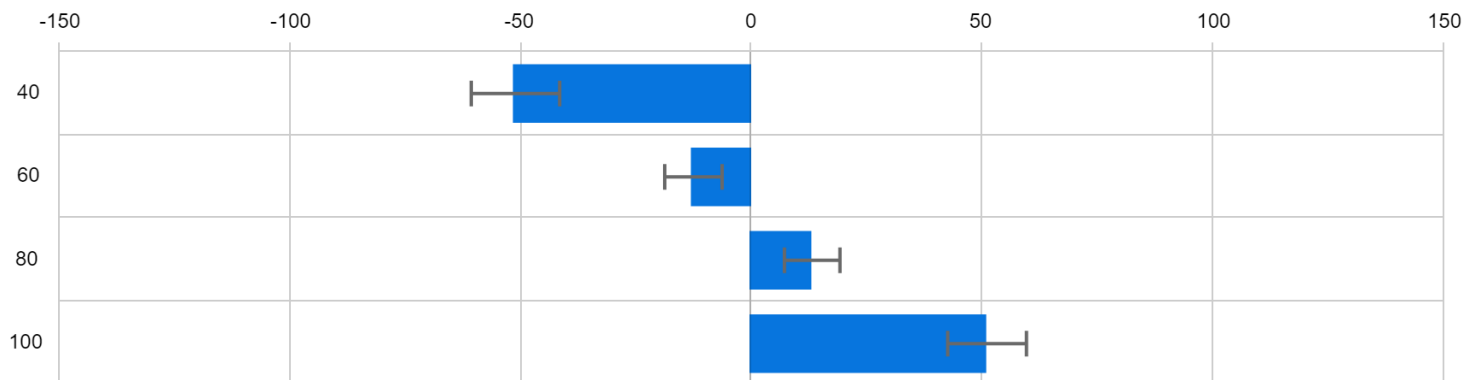
N=82



Utility Chart 5: Price per Month

Off Net Minutes Per Month

N=82



Utility chart 6: Off-Net Minutes per Month

Group_Proj.R

musssa

2021-12-12

```
library(readxl)
data<-read_excel("C:/Users/musssa/Downloads/CBC_Response_Data.xlsx")
View(data)
data

## # A tibble: 4,866 x 9
##   Id Task Concept Payment_Type_For_Te- On_Net_Mins_Per_M- Off_Net_Minutes_-
##   <dbl> <dbl>   <dbl> <chr>          <dbl>          <dbl>
## 1 257    1      1 Postpaid          80          100
## 2 257    1      2 Postpaid          60          60
## 3 257    1      3 Prepaid          40          60
## 4 257    1      4 Postpaid          60          80
## 5 257    1      5 Prepaid          40          40
## 6 257    2      2 Postpaid          60          100
## 7 257    2      3 Subscription  80          80
## 8 257    2      4 Postpaid          100         60
## 9 257    3      1 Prepaid          60          60
## 10 257    3      2 Subscription  60          60
## # ... with 4,856 more rows, and 3 more variables: GBs_per_month <chr>,
## #   How_much_are_willing_to_pay_per_month?(PKR) <dbl>, Response <dbl>

str(data)
```

```
## tibble [4,866 x 9] (S3: tbl_df/tbl/data.frame)
## $ Id : num [1:4866] 257 257 257 257 257 257 257 257 257 ...
## $ Task : num [1:4866] 1 1 1 2 2 2 2 2 3 3 ...
## $ Concept : chr [1:4866] "Prepaid" "Postpaid" "Prepaid" "Postpaid" ...
## $ Payment_Type_for_Telephone_Package : num [1:4866] 88 60 40 100 40 80 80 80 80 60 ...
## $ On_Net_Mins_Per_Month : num [1:4866] 88 60 40 100 40 80 80 80 80 60 ...
## $ Off_Net_Minutes_Per_Month : num [1:4866] 100 40 60 80 60 80 80 80 80 60 ...
## $ GBs_per_month : chr [1:4866] "10GBs" "20GBs" "25GBs" "15GBs" ...
## $ How_much_are_willing_to_pay_per_month?(PKR): num [1:4866] 900 300 700 500 500 700 900 300 500 ...
## $ Response : num [1:4866] 1 0 0 1 0 0 0 1 0 ...

data$Payment_Type_for_Telephone_Package<-as.factor(data$Payment_Type_for_Telephone_Package)
data$On_Net_Mins_Per_Month<-as.factor(data$On_Net_Mins_Per_Month)
data$Off_Net_Minutes_Per_Month<-as.factor(data$Off_Net_Minutes_Per_Month)
data$GBs_per_month<-as.factor(data$GBs_per_month)
data<-within(data,GBs_per_month~relevel(GBs_per_month,ref="5GBs"))
str(data)
```

```
## tibble [4,866 x 9] (S3: tbl_df/tbl/data.frame)
## $ Id : num [1:4866] 257 257 257 257 257 257 257 257 257 ...
## $ Task : num [1:4866] 1 1 1 2 2 2 2 2 3 3 ...
## $ Concept : num [1:4866] 1 2 3 4 1 2 3 4 1 2 ...
## $ Payment_Type_for_Telephone_Package : Factor w/ 3 levels "Prepaid", "Postpaid",...: 2 2 1 2 1 2 3 3 1
## $ On_Net_Mins_Per_Month : Factor w/ 4 levels "40", "60", "80",...: 3 2 1 4 1 2 3 4 3 2 ...
## $ Off_Net_Minutes_Per_Month : Factor w/ 4 levels "40", "60", "80",...: 4 1 2 3 1 4 3 2 3 2 ...
## $ GBs_per_month : Factor w/ 5 levels "5GBs", "10GBs",...: 2 4 5 3 1 5 4 2 5 1 ...
## $ How_much_are_willing_to_pay_per_month?(PKR): num [1:4866] 900 300 700 500 500 700 900 300 500 ...
## $ Response : num [1:4866] 1 0 0 1 0 0 0 1 0 ...

#install.packages("logit")
```

```
## Warning: package 'logit' was built under R version 4.1.2
```

```
## Loading required package: dffdx
```

```
##
## Attaching package: 'dffdx'
```

```
## The following object is masked from 'package:stats':
## filter
```

```
mic_logit<-logit(data,data,shape="long", choice="Response",alt.var = "Concept")
data<-logit(Response=Payment_Type_for_Telephone_Package~On_Net_Mins_Per_Month+Off_Net_Minutes_Per_Month+GBs_per_mo
nth+How_much_are_willing_to_pay_per_month?(PKR) ,data=data,logit)
summary(m1)
```

```
## Call:
## logit(formula = Response ~ Payment_Type_for_Telephone_Package +
## On_Net_Mins_Per_Month + Off_Net_Minutes_Per_Month + GBs_per_month +
## How_much_are_willing_to_pay_per_month?(PKR) , data = data,logit,
## method = "nr")
##
## Frequencies of alternatives:choice
##      1      2      3      4
## 0.35226 0.24280 0.20741 0.19753
##
## nr method
## 5 iterations, 0m:0m:0s
## g'(-H)~lg = 7.61E-05
## Successive function values within tolerance limits
##
## Coefficients :
##              Estimate Std. Error z-value
## (Intercept):2      -0.65451582  0.08391068  -5.1779
## (Intercept):3      -0.67223826  0.08740752  -6.5468
## (Intercept):4      -0.69758133  0.08934449  -7.8078
## Payment_Type_for_Telephone_PackagePostpaid -0.01679439  0.08700738  -0.2145
## Payment_Type_for_Telephone_PackageSubscription  0.18542670  0.08831522  1.7699
## On_Net_Mins_Per_Month60  0.15575204  0.09599040  1.6226
## On_Net_Mins_Per_Month80  0.19389496  0.09595093  2.0184
## On_Net_Mins_Per_Month100  0.16823863  0.09542168  1.8111
## Off_Net_Minutes_Per_Month60  0.10472895  0.09654934  1.0847
## Off_Net_Minutes_Per_Month80  0.12067722  0.09556057  1.2628
## Off_Net_Minutes_Per_Month100  0.32338967  0.09421778  3.4197
## GBs_per_month5GBs  0.05089265  0.11422597  0.4209
## GBs_per_month10GBs  0.86295012  0.11830912  7.2930
## GBs_per_month20GBs  1.20210961  0.10931359  10.9969
## GBs_per_month25GBs  0.60829099  0.14075727  -4.3630
## How_much_are_willing_to_pay_per_month?(PKR)  -0.00231270  0.00015637 -14.7711
## Pr(>|z|)
## (Intercept):2      2.244e-07 ***
## (Intercept):3      8.370e-11 ***
## (Intercept):4      5.773e-15 ***
## Payment_Type_for_Telephone_PackagePostpaid  0.8303339
## Payment_Type_for_Telephone_PackageSubscription  0.0784233 .
## On_Net_Mins_Per_Month60  0.172442613
## On_Net_Mins_Per_Month80  0.04355225 *
## On_Net_Mins_Per_Month100  0.0049374 **
## Off_Net_Minutes_Per_Month60  0.2708459
## Off_Net_Minutes_Per_Month80  0.172442613
## Off_Net_Minutes_Per_Month100  0.0060269 ***
## GBs_per_month5GBs  0.471e-06 ***
## GBs_per_month10GBs  0.107e-15 ***
## GBs_per_month20GBs  < 2.2e-16 ***
## GBs_per_month25GBs  7.015e-07 ***
## How_much_are_willing_to_pay_per_month?(PKR)  < 2.2e-16 ***
##
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Log Likelihood: -1331.2
## # of parameters: 48, 17491
## Likelihood ratio test: chisq = 577.13 (p.value = < 2.2e-16)
```

```
xtabs(Response~How_much_are_willing_to_pay_per_month?(PKR),data=data)
```

```
## How_much_are_willing_to_pay_per_month?(PKR)
## 300 500 700 900
## 479 345 242 149
```

```
m2<-m1~logit(Response~0+Payment_Type_for_Telephone_Package+On_Net_Mins_Per_Month+Off_Net_Minutes_Per_Month+GBs_
summary(m2)
```

```
## Call:
## logit(formula = Response ~ 0 + Payment_Type_for_Telephone_Package +
## On_Net_Mins_Per_Month + Off_Net_Minutes_Per_Month + GBs_per_month +
## How_much_are_willing_to_pay_per_month?(PKR) , data = data,logit,
## method = "nr")
##
## Frequencies of alternatives:choice
##      1      2      3      4
## 0.35226 0.24280 0.20741 0.19753
##
## nr method
## 5 iterations, 0m:0m:0s
## g'(-H)~lg = 3.25E-05
## Successive function values within tolerance limits
##
## Coefficients :
##              Estimate Std. Error z-value
## Payment_Type_for_Telephone_PackagePostpaid -0.00912000  0.0866684 -0.1052
## Payment_Type_for_Telephone_PackageSubscription  0.1523713  0.0870099 -1.7452
## On_Net_Mins_Per_Month60  0.1870363  0.0946014  1.9768
## On_Net_Mins_Per_Month80  0.1724426  0.0945991  1.8229
## On_Net_Mins_Per_Month100  0.2608803  0.0939449  2.7781
## Off_Net_Minutes_Per_Month60  0.1108738  0.0951925  1.1647
## Off_Net_Minutes_Per_Month80  0.11817783  0.0944259  1.2583
## Off_Net_Minutes_Per_Month100  0.3225674  0.0924484  3.4892
## GBs_per_month10GBs  0.0507548  0.1120998  0.44788
## GBs_per_month15GBs  0.0630582  0.1089635  0.5802
## GBs_per_month20GBs  1.1839276  0.1076339  10.9912
## GBs_per_month25GBs  0.6614463  0.1306730  -4.7357
## How_much_are_willing_to_pay_per_month?(PKR)  -0.0022401  0.0001538 -14.5652
## Pr(>|z|)
## Payment_Type_for_Telephone_PackagePostpaid  0.9151939
## Payment_Type_for_Telephone_PackageSubscription  0.0005959 .
## On_Net_Mins_Per_Month60  0.0646124
## On_Net_Mins_Per_Month80  0.0683219
## On_Net_Mins_Per_Month100  0.0054678 **
## Off_Net_Minutes_Per_Month60  0.2441283
## Off_Net_Minutes_Per_Month80  0.2002768
## Off_Net_Minutes_Per_Month100  0.0064045 ***
## GBs_per_month5GBs  7.505e-06 ***
## GBs_per_month10GBs  1.998e-15 ***
## GBs_per_month15GBs  < 2.2e-16 ***
## GBs_per_month20GBs  2.183e-06 ***
## GBs_per_month25GBs  < 2.2e-16 ***
## How_much_are_willing_to_pay_per_month?(PKR)  < 2.2e-16 ***
##
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Log Likelihood: -1399.2
```

```
lrtest(m1,m2)
```

```
## Likelihood ratio test
##
## Model 1: Response ~ 0 + Payment_Type_for_Telephone_Package + On_Net_Mins_Per_Month +
## Off_Net_Minutes_Per_Month + GBs_per_month + How_much_are_willing_to_pay_per_month?(PKR)
## Model 2: Response ~ 0 + Payment_Type_for_Telephone_Package + On_Net_Mins_Per_Month +
## Off_Net_Minutes_Per_Month + GBs_per_month + How_much_are_willing_to_pay_per_month?(PKR)
## # of LogLik DF Chisq Pr(>Chisq)
## 1 13 -1399.2
## 2 13 -1399.2 0 0 1
```

```
coef(m2)
```

```
## Payment_Type_for_Telephone_PackagePostpaid
## -0.009120052
## Payment_Type_for_Telephone_PackageSubscription
## -0.152371280
## On_Net_Mins_Per_Month60
## 0.187036282
## On_Net_Mins_Per_Month80
## 0.172442613
## On_Net_Mins_Per_Month100
## 0.260988324
## Off_Net_Minutes_Per_Month60
## 0.110873522
## Off_Net_Minutes_Per_Month80
## 0.118177783
## Off_Net_Minutes_Per_Month100
## 0.322567419
## GBs_per_month10GBs
## 0.050704847
## GBs_per_month15GBs
## 0.063958156
## GBs_per_month20GBs
## 1.183927592
## GBs_per_month25GBs
## -0.661446287
## How_much_are_willing_to_pay_per_month?(PKR)
## -0.002240135
```

```
coef(m2)/coef(m2)[1]*How_much_are_willing_to_pay_per_month?(PKR)~1
```

```
## Payment_Type_for_Telephone_PackagePostpaid
## -4.673206
## Payment_Type_for_Telephone_PackageSubscription
## -68.010787
## On_Net_Mins_Per_Month60
## 83.493301
## On_Net_Mins_Per_Month80
## 76.978663
## On_Net_Mins_Per_Month100
## 116.505612
## Off_Net_Minutes_Per_Month60
## 49.494129
## Off_Net_Minutes_Per_Month80
## 53.940451
## Off_Net_Minutes_Per_Month100
## 143.994629
## GBs_per_month10GBs
## 225.747466
## GBs_per_month15GBs
## 385.673226
## GBs_per_month20GBs
## 528.105441
## GBs_per_month25GBs
## -295.276988
## How_much_are_willing_to_pay_per_month?(PKR)
## -1.000000
```

```
#Simulating Choice shares
predict.mnl<-function(model,data){
  data.model<-model.matrix(update(model$formula, 0~.), data=data)[,1]
  values<-data.model%*%model$coef
  share<-exp(values)/sum(exp(values))
  cbind(share,data)
}
```

```
attrib<-list(Payment_Type_for_Telephone_Packages["Prepaid","Postpaid","Subscription"],
On_Net_Mins_Per_Month=c("40","60","80","100"),
Off_Net_Minutes_Per_Month=c("40","60","80","100"),
GBs_per_month=c("5GBs","10GBs","15GBs","20GBs","25GBs"),
How_much_are_willing_to_pay_per_month?(PKR) ~c(300,500,700,900)
)
```

```
allcombinations<-expand.grid(attrib)
marketprofiles<-allcombinations[c(1,)]
predict.mnl(m2, marketprofiles)
```

```
## [1] Share
## [2] Payment_Type_for_Telephone_Package
## [3] On_Net_Mins_Per_Month
## [4] Off_Net_Minutes_Per_Month
## [5] GBs_per_month
## [6] How_much_are_willing_to_pay_per_month?(PKR)
## <0 rows> (or 0-length row.names)
```

```
#Segmenting the customers
segment<-read_excel("C:/Users/musssa/Downloads/Segment_Sheet.xlsx")
segment
```

```
## # A tibble: 55 x 8
##   Resp_ID Imp_calls? Imp_Social_Media? Imp_Internet? Imp_text? Imp_stream?
##   <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1 1 6 9 7 3
## 2 2 3 10 8 2
## 3 3 5 8 8 4
## 4 4 5 10 9 1
## 5 5 3 7 6 5
## 6 6 10 9 7 7
## 7 7 7 8 9 5
## 8 8 2 6 6 4
## 9 9 3 6 7 4
## 10 10 18 4 6 4 1
```

```
## # ... with 45 more rows, and 3 more variables: Imp_stream? <dbl>,
## #   Imp_YouTube? <dbl>, Imp_attend_classes? <dbl>

View(segment)
```

```
seg<-segment[c(2:8)]
scale_seg<-scale(seg)
scale_seg
```

```
## Imp_calls? Imp_Social_Media? Imp_Internet? Imp_text? Imp_stream?
## [1,] 0.29331881 0.003882129 -0.7871068 0.8733128 -0.9489395
## [2,] -0.78216217 0.110640684 0.0000000 1.3954019 0.1854800
## [3,] -0.06518018 0.110640684 0.0000000 0.0000000 -0.0480395
## [4,] -0.06518018 -0.110640684 0.7971068 -1.0174011 -0.3812767
## [5,] -0.78216217 -0.209834980 -1.4142136 0.1708655 0.7522487
## [6,] 0.65180181 0.003882129 0.7971068 1.2150439 -0.3812767
## [7,] 0.65180181 -0.102876425 0.7971068 0.1708655 -0.3812767
## [8,] -1.14065317 -0.102876425 -1.4142136 0.1708655 1.3109114
## [9,] -0.78216217 -0.316393534 0.7971068 -0.3512236 -0.3812767
## [10,] 0.42367118 -0.316393534 -2.8284271 -1.9174011 -2.0015489
## [11,] -1.49914416 0.110640684 1.4142136 0.6292547 0.1854800
## [12,] -0.78216217 -0.102876425 0.7971068 -1.0174011 0.1854800
## [13,] 0.65180181 0.003882129 0.7971068 0.1708655 -1.5148022
## [14,] -1.72727480 -0.102876425 0.7971068 0.6292547 -0.3812767
## [15,] 0.65180181 0.110640684 0.7971068 0.1708655 -3.2159904
## [16,] 0.29331881 -0.102876425 -0.7871068 -0.3512236 -2.6483276
## [17,] 0.65180181 -0.102876425 0.7971068 1.2150439 0.3812767
## [18,] 0.65180181 0.316393534 1.4142136 0.6292547 0.1854800
## [19,] -1.14065317 -0.316393534 0.0000000 0.1708655 -0.1854800
## [20,] -0.78216217 0.110640684 1.4142136 -0.8733128 0.7522487
## [21,] 0.42367118 -0.102876425 -0.7871068 -0.3512236 -0.9489395
## [22,] -1.49914416 0.003882129 0.7971068 0.3512236 0.7522487
## [23,] -0.78216217 0.110640684 0.0000000 0.1708655 0.7522487
## [24,] 0.65180181 -0.102876425 0.0000000 0.1708655 -0.9489395
## [25,] -1.72727480 0.110640684 0.0000000 0.6292547 -0.3812767
## [26,] 0.65180181 0.209834980 -1.4142136 0.1708655 -2.0015489
## [27,] 0.29331881 0.003882129 1.4142136 0.1708655 -1.5148022
## [28,] 0.65180181 -0.102876425 0.0000000 1.2150439 0.7522487
## [29,] -0.78216217 0.316393534 1.4142136 0.6292547 0.1854800
## [30,] -1.14065317 -0.316393534 0.0000000 -0.3512236 0.7522487
## [31,] -0.06518018 -0.316393534 1.4142136 0.6292547 0.7522487
## [32,] 0.42367118 -0.102876425 -0.7871068 -0.3512236 -0.9489395
## [33,] -1.72727480 -0.102876425 0.0000000 0.6292547 -0.3812767
## [34,] 0.65180181 0.003882129 -0.7871068 0.6292547 1.3109114
## [35,] -1.14065317 -0.102876425 0.0000000 0.1708655 -0.1854800
## [36,] -0.78216217 0.110640684 0.0000000 0.1708655 1.3109114
## [37,] 0.42367118 -0.102876425 -0.7871068 0.1708655 -0.3812767
## [38,] -1.49914416 -0.102876425 -0.7871068 0.6292547 0.7522487
## [39,] 0.65180181 -0.316393534 -0.7871068 -0.8733128 0.1854800
## [40,] 0.65180181 0.110640684 0.0000000 0.1708655 -0.9489395
## [41,] -1.72727480 0.316393534 -0.7871068 0.6292547 0.1854800
## [42,] 0.65180181 -0.102876425 0.7971068 -0.8733128 -0.9489395
## [43,] 0.65180181 0.110640684 -1.4142136 2.7831114 1.3109114
## [44,] 0.65180181 -0.529910643 0.7971068 1.2150439 0.1854800
## [45,] 0.29331881 -0.636609198 0.7971068 -1.3954019 0.7522487
## [46,] 1.72727480 -0.316393534 -1.4142136 -0.8733128 0.1854800
## [47,] 0.65180181 -0.423152069 -0.7871068 -0.3512236 1.3109114
## [48,] -1.14065317 -1.56705282 -2.8284271 -1.0174011 -0.1854800
## [49,] -0.78216217 -0.209834980 1.4142136 -0.8733128 0.1854800
## [50,] 0.42367118 -0.209834980 0.7971068 1.2150439 -0.3812767
## [51,] -1.49914416 0.209834980 0.7971068 2.7831114 0.1854800
## [52,] 0.65180181 -0.102876425 0.7971068 0.6292547 0.7522487
## [53,] 0.65180181 -0.529910643 -0.7871068 0.1708655 0.7522487
## [54,] -1.49914416 0.316393534 0.7971068 -0.3512236 0.7522487
## [55,] 0.74972611 0.34420460
```

```
## Imp_YouTube? Imp_attend_classes?
## [1,] -1.38311541 -0.86417324
## [2,] -0.7216824 0.34420460
## [3,] -2.0946258 0.74699721
## [4,] -0.67216824 0.34420460
## [5,] 0.03877894 1.14978982
## [6,] -1.38311541 1.14978982
## [7,] 0.03877894 0.74699721
## [8,] 1.46667328 0.34420460
## [9,] 0.03877894 1.14978982
## [10,] -2.0946258 -1.69075846
## [11,] -0.67216824 1.14978982
## [12,] 0.03877894 1.14978982
## [13,] -1.38311541 -1.69075846
## [14,] -0.7216824 -2.47543490
## [15,] -2.80500975 -0.86417324
## [16,] -1.38311541 -2.0725107
## [17,] 1.46667328 -0.43210802
## [18,] 0.74972611 0.34420460
## [19,] 0.74972611 -0.46338063
## [20,] 0.74972611 -0.05858802
## [21,] -0.67216824 -0.05858802
## [22,] 0.74972611 -0.05858802
## [23,] 0.74972611 -0.05858802
## [24,] 1.46667328 1.14978982
## [25,] 0.03877894 -0.05858802
## [26,] 1.46667328 -1.26696585
## [27,] -0.67216824 0.34420460
## [28,] 0.74972611 0.34420460
## [29,] 0.03877894 -0.86417324
## [30,] 0.03877894 -0.05858802
## [31,] -1.38311541 -2.0725107
## [32,] -1.38311541 -1.69075846
## [33,] 1.46667328 -0.05858802
## [34,] 0.03877894 0.34420460
## [35,] 0.74972611 0.34420460
## [36,] 0.03877894 0.74699721
## [37,] 1.46667328 -0.46338063
## [38,] 0.03877894 -0.46338063
## [39,] 0.03877894 0.74699721
## [40,] 0.03877894 0.74699721
## [41,] 0.03877894 -0.05858802
## [42,] 0.03877894 -1.26696585
## [43,] 0.03877894 1.14978982
## [44,] 0.74972611 0.74699721
## [45,] 0.03877894 0.74699721
## [46,] 1.46667328 0.74699721
## [47,] 0.03877894 -0.05858802
## [48,] 0.03877894 0.74699721
## [49,] 0.03877894 0.74699721
## [50,] -0.7216824 0.34420460
## [51,] 0.03877894 0.34420460
## [52,] 0.03877894 1.14978982
## [53,] 0.74972611 -0.05858802
## [54,] 0.74972611 0.74699721
## [55,] 0.74972611 0.34420460
```

```
## attr(,"scaled:center")
## attr(,"scaled:scale")
## attr(,"Imp_calls? Imp_Social_Media? Imp_Internet? Imp_text? Imp_stream?
## 5.181818 8.963636 1.000000 4.272227 5.636364
## Imp_stream? Imp_YouTube? Imp_attend_classes?
## 7.672227 7.945455 7.145455
## attr(,"scaled:center")
## attr(,"scaled:scale")
## attr(,"Imp_calls? Imp_Social_Media? Imp_Internet? Imp_text? Imp_stream?
## 2.789470 9.366931 1.414214 1.915382
## Imp_stream? Imp_YouTube? Imp_attend_classes?
## 1.764487 1.466574 2.482607
```

```
distances<-dist(scale_seg)
clusterresponddents<-hclust(distances, method="ward.D2")
plot(clusterresponddents)
```

```
## Cluster Dendrogram
##
## distances
## hclust("ward.D2")
## plot(clusterresponddents, labels=F, hang=1, main="Dendrogram for Telephone needs")
## rclust(clusterresponddents, k=4, border="red")
```

```
Dendrogram for Telephone needs
```

```
## Library(factoextra)
##
## Loading required package: ggplot2
##
## Warning: package 'ggplot2' was built under R version 4.1.2
##
## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/v9w9Ba
```

```
fviz_nbclust(scale_seg,FUN=hcut,method="wss")
```

```
## Optimal number of clusters
##
## clustergroups<-cutree(clusterresponddents, k=4)
## table(clustergroups)
```