

```

library(caret)
library(knitr)

set.seed(1234)

Train_BD = read_excel("IMB651-XLS-ENG.xlsx", sheet = "Training Data or Binary Class")

Test_BD = read_excel("IMB651-XLS-ENG.xlsx", sheet = "Test Data for Binary Class")

Train_MD = read_excel("IMB651-XLS-ENG.xlsx", sheet = "Training Data for Multi-Class M")

Test_MD = read_excel("IMB651-XLS-ENG.xlsx", sheet = "Test Data for Multi-Class Model")

Data_BD = rbind.data.frame(Train_BD, Test_BD)

Data_MD = rbind.data.frame(Train_MD, Test_MD)

Data_Multi = rbind.data.frame(Train_MD, Test_MD)

Data_MD[, 13:47] = lapply(Data_MD[, 13:47], function(x) factor(x, levels = 1:4,
ordered = T))

Data_MD = Data_MD %>% mutate_if(is.character, as.factor)

Data_MD$CE_NPS = factor(Data_MD$CE_NPS, levels = 0:10, ordered = T)

Data_MD = Data_MD[, -which(names(Data_MD) %in% c("AdmissionDate", "DischargeDate"))]

Data_MD$NPS_Status = as.factor(ifelse(Data_MD$NPS_Status %in% c("Passive", "Promotor"),
0, 1))

Data_BD[, 13:47] = lapply(Data_BD[, 13:47], function(x) factor(x, levels = 1:4,
ordered = T))

Data_BD = Data_BD %>% mutate_if(is.character, as.factor)

Data_BD$CE_NPS = factor(Data_BD$CE_NPS, levels = 0:10, ordered = T)

Data_BD$CE_NPS = as.factor(Data_BD$CE_NPS)

Data_BD = Data_BD[, -which(names(Data_BD) %in% c("AdmissionDate", "DischargeDate"))]

Data_New = Data_MD[, -c(1, 2)]

split(names(Data_New), sapply(Data_New, function(x) paste(class(x), collapse = " ")))

## $factor
## [1] "MaritalStatus"      "Sex"                  "BedCategory"
## [4] "Department"         "InsPayorcategory" "State"
## [7] "Country"            "STATEZONE"          "NPS_Status"
##
## $numeric
## [1] "AgeYrs"             "Estimatedcost"     "LengthofStay"

```

```

## 
## $`ordered factor` 
## [1] "CE_ACCESSIBILITY"           "CE_CSAT"
## [3] "CE_VALUEFORMONEY"          "EM_IMMEDIATEATTENTION"
## [5] "EM_NURSING"                 "EM_DOCTOR"
## [7] "EM_OVERALL"                  "AD_TIME"
## [9] "AD_TARRIFFPACKAGESEXPLAINATION" "AD_STAFFATTITUDE"
## [11] "INR_ROOMCLEANLINESS"        "INR_ROOMPEACE"
## [13] "INR_ROOMEQUIPMENT"          "INR_ROOMAMBIENCE"
## [15] "FNB_FOODQUALITY"            "FNB_FOODDELIVERYTIME"
## [17] "FNB_DIETICIAN"              "FNB_STAFFATTITUDE"
## [19] "AE_ATTENDEECARE"             "AE_PATIENTSTATUSINFO"
## [21] "AE_ATTENDEEFOOD"             "DOC_TREATMENTEXPLAINATION"
## [23] "DOC_ATTITUDE"                "DOC_VISITS"
## [25] "DOC_TREATMENTEFFECTIONESS"   "NS_CALLBELLRESPONSE"
## [27] "NS_NURSESATTITUDE"           "NS_NURSEPROACTIVENESS"
## [29] "NS_NURSEPATIENCE"             "OVS_OVERALLSTAFFATTITUDE"
## [31] "OVS_OVERALLSTAFFPROMPTNESS"   "OVS_SECURITYATTITUDE"
## [33] "DP_DISCHARGETIME"             "DP_DISCHARGEQUERIES"
## [35] "DP_DISCHARGEPROCESS"          "CE_NPS"

```

`ExpData(Data_BD, 1)`

##	Descriptions	Obs
## 1	Sample size (Nrow)	5353
## 2	No. of Variables (Ncol)	50
## 3	No. of Numeric Variables	5
## 4	No. of Factor Variables	45
## 5	No. of Text Variables	0
## 6	No. of Logical Variables	0
## 7	No. of Date Variables	0
## 8	No. of Zero variance Variables (Uniform)	0
## 9	%. of Variables having complete cases	100% (50)
## 10	%. of Variables having <50% missing cases	0% (0)
## 11	%. of Variables having >50% missing cases	0% (0)
## 12	%. of Variables having >90% missing cases	0% (0)

`ExpData(Data_MD, 1)`

##	Descriptions	Obs
## 1	Sample size (Nrow)	5353
## 2	No. of Variables (Ncol)	50
## 3	No. of Numeric Variables	5
## 4	No. of Factor Variables	45
## 5	No. of Text Variables	0
## 6	No. of Logical Variables	0
## 7	No. of Date Variables	0
## 8	No. of Zero variance Variables (Uniform)	0
## 9	%. of Variables having complete cases	100% (50)
## 10	%. of Variables having <50% missing cases	0% (0)
## 11	%. of Variables having >50% missing cases	0% (0)
## 12	%. of Variables having >90% missing cases	0% (0)

```
sum(is.na(Data_BD))
```

```
## [1] 0
```

```
sum(is.na(Data_MD))
```

```
## [1] 0
```

There are no missing values in the dataset.

Part 3

③

		Predicted		
		A	B	C
Actual	A	TP _A	E _{AB}	E _{AC}
	B	E _{BA}	TP _B	E _{BC}
	C	E _{CA}	E _{CB}	TP _C

$$\text{Specificity} = \frac{TN}{TN+FP} \quad \text{Sensitivity} = \frac{TP}{TP+FN}$$

(a) Specificity of A = $\frac{TN_A}{TN_A+E_{BA}+E_{CA}} = \frac{TP_B+E_{BC}+E_{CB}+TP_C}{(TP_B+E_{BC}+E_{CB}+TP_C)+E_{BA}+E_{CA}}$

$$\text{Sensitivity of A} = \frac{TP_A}{TP_A+E_{AB}+E_{AC}}$$

(b) Specificity of B = $\frac{TN_B}{TN_B+E_{AB}+E_{CB}} = \frac{TP_A+E_{AC}+E_{CA}+TP_C}{(TP_A+E_{AC}+E_{CA}+TP_C)+E_{AB}+E_{CB}}$

$$\text{Sensitivity of B} = \frac{TP_B}{TP_B+E_{BA}+E_{BC}}$$

(c) Specificity of C = $\frac{TN_C}{TN_C+E_{AC}+E_{BC}} = \frac{TP_A+E_{AB}+E_{BA}+TP_B}{(TP_A+E_{AB}+E_{BA}+TP_B)+E_{AC}+E_{BC}}$

$$\text{Sensitivity of C} = \frac{TP_C}{TP_C+E_{CA}+E_{CB}}$$



Part 4

```

Index = sample(2, nrow(Data_New), replace = T, prob = c(0.8, 0.2))

Train = Data_New[Index == 1, ]

Test = Data_New[Index == 2, ]

options(scipen = 99)

Model_GLM_1 = glm(NPS_Status ~ . - CE_NPS, data = Train, family = binomial,
  method = "detect_separation", linear_program = "dual")

Model_GLM_1

## Separation: FALSE
## Existence of maximum likelihood estimates
##             (Intercept) MaritalStatusMarried
##                         -Inf
## MaritalStatusSeparated MaritalStatusSingle
##                         -Inf
## MaritalStatusWidowed AgeYrs
##                         0
##                         SexM BedCategoryDAYCARE
##                         Inf
##                         0 BedCategoryGENERAL HD
##                         Inf
## BedCategoryITU BedCategoryRenal ICU
##                         -Inf
## BedCategorySEMISPECIAL BedCategorySEMISPECIAL HD
##                         Inf
##                         Inf BedCategoryULTRA DLX
##                         Inf
## BedCategoryULTRA SPL DepartmentGEN
##                         Inf
##                         0 DepartmentORTHO
##                         0
## DepartmentGYNAEC DepartmentRENAL
##                         0
##                         0 DepartmentPEDIATRIC
##                         0
## DepartmentSPECIAL Estimatedcost
##                         0
##                         0 InsPayorcategoryEXEMPTION
##                         0
## InsPayorcategoryINTERNATIONAL InsPayorcategoryPATIENT
##                         0
##                         0
## StateAndaman And Nicobar StateAndhra Pradesh
##                         -Inf
##                         Inf
## StateAssam StateBangladesh
##                         Inf
##                         -Inf
## StateBhubaneshwar StateBihar
##                         -Inf
##                         Inf
## StateChandigarh StateChhattisgarh
##                         -Inf
##                         Inf

```

##	StateDarjeeling	StateDelhi
##	-Inf	Inf
##	StateDoha	StateGoa
##	-Inf	Inf
##	StateGujarat	StateHaryana
##	-Inf	-Inf
##	StateInternational	StateIraq
##	-Inf	-Inf
##	StateJharkand	StateJharkhand
##	-Inf	-Inf
##	StateKarnataka	StateKenya
##	Inf	-Inf
##	StateKerala	StateKolkata
##	Inf	-Inf
##	StateKolkatta	StateMadhya Pradesh
##	Inf	Inf
##	StateMaharashtra	StateMaldives
##	Inf	Inf
##	StateManipur	StateMauritius
##	-Inf	-Inf
##	StateMeghalaya	StateMizoram
##	-Inf	-Inf
##	StateMongolia	StateMumbai
##	Inf	-Inf
##	StateNepal	StateNew Zealand
##	-Inf	Inf
##	StateNigeria	StateOman
##	-Inf	-Inf
##	StateOntario	StateOrissa
##	Inf	Inf
##	StatePunjab	StateRajasthan
##	Inf	-Inf
##	StateRanchi	StateRWANDA
##	Inf	Inf
##	StateSaudi Arabia	StateTamil Nadu
##	-Inf	Inf
##	StateTanzania	StateTripura
##	-Inf	-Inf
##	StateUAE	StateUK
##	-Inf	Inf
##	StateUnknown	StateUSA
##	Inf	-Inf
##	StateUttar Pradesh	StateUttarakhand
##	Inf	-Inf
##	StateWest Bengal	StateZimbabwe
##	Inf	-Inf
##	CountryANGOLA	CountryBANGLADESH
##	-Inf	-Inf
##	CountryCANADA	CountryFIJI
##	NA	-Inf
##	CountryINDIA	CountryIRAQ
##	0	-Inf
##	CountryISLAMIC REPUBLIC OF IRAN	CountryKENYA
##	-Inf	NA

##	CountryMALDIVES	CountryMAURITIUS
##	NA	-Inf
##	CountryMONGOLIA	CountryMOZAMBIQUE
##	NA	-Inf
##	CountryNEPAL	CountryNEW ZEALAND
##	-Inf	NA
##	CountryNIGERIA	CountryOMAN
##	-Inf	-Inf
##	CountryQATAR	CountrySaudi Arabia
##	NA	-Inf
##	CountrySAUDI ARABIA	CountrySUDAN
##	NA	-Inf
##	CountryUGANDA	CountryUNITED ARAB EMIRATES
##	NA	NA
##	CountryUNITED KINGDOM	CountryUNITED REPUBLIC OF TANZANIA
##	NA	NA
##	CountryUNITED STATES OF AMERICA	CountryYEMEN
##	NA	NA
##	CountryZIMBABWE	STATEZONEEAST
##	NA	NA
##	STATEZONEINTERNATIONAL	STATEZONENORTH
##	NA	NA
##	STATEZONESOUTH	STATEZONEUnknown
##	NA	NA
##	STATEZONEWEST	CE_ACCESSIBILITY.L
##	NA	0
##	CE_ACCESSIBILITY.Q	CE_ACCESSIBILITY.C
##	0	0
##	CE_CSAT.L	CE_CSAT.Q
##	0	0
##	CE_CSAT.C	CE_VALUEFORMONEY.L
##	0	0
##	CE_VALUEFORMONEY.Q	CE_VALUEFORMONEY.C
##	0	0
##	EM_IMMEDIATEATTENTION.L	EM_IMMEDIATEATTENTION.Q
##	0	0
##	EM_IMMEDIATEATTENTION.C	EM_NURSING.L
##	0	0
##	EM_NURSING.Q	EM_NURSING.C
##	0	0
##	EM_DOCTOR.L	EM_DOCTOR.Q
##	0	0
##	EM_DOCTOR.C	EM_OVERALL.L
##	0	0
##	EM_OVERALL.Q	EM_OVERALL.C
##	0	0
##	AD_TIME.L	AD_TIME.Q
##	0	0
##	AD_TIME.C	AD_TARIFFPACKAGESEXPLINATION.L
##	0	0
##	AD_TARIFFPACKAGESEXPLINATION.Q	AD_TARIFFPACKAGESEXPLINATION.C
##	0	0
##	AD_STAFFATTITUDE.L	AD_STAFFATTITUDE.Q
##	0	0

##	AD_STAFFATTITUDE.C	INR_ROOMCLEANLINESS.L
##	0	0
##	INR_ROOMCLEANLINESS.Q	INR_ROOMCLEANLINESS.C
##	0	0
##	INR_ROOMPEACE.L	INR_ROOMPEACE.Q
##	0	0
##	INR_ROOMPEACE.C	INR_ROOMEQUIPMENT.L
##	0	0
##	INR_ROOMEQUIPMENT.Q	INR_ROOMEQUIPMENT.C
##	0	0
##	INR_ROOMAMBIENCE.L	INR_ROOMAMBIENCE.Q
##	0	0
##	INR_ROOMAMBIENCE.C	FNB_FOODQUALITY.L
##	0	0
##	FNB_FOODQUALITY.Q	FNB_FOODQUALITY.C
##	0	0
##	FNB_FOODDELIVERYTIME.L	FNB_FOODDELIVERYTIME.Q
##	0	0
##	FNB_FOODDELIVERYTIME.C	FNB_DIETICIAN.L
##	0	0
##	FNB_DIETICIAN.Q	FNB_DIETICIAN.C
##	0	0
##	FNB_STAFFATTITUDE.L	FNB_STAFFATTITUDE.Q
##	0	0
##	FNB_STAFFATTITUDE.C	AE_ATTENDEECARE.L
##	0	0
##	AE_ATTENDEECARE.Q	AE_ATTENDEECARE.C
##	0	0
##	AE_PATIENTSTATUSINFO.L	AE_PATIENTSTATUSINFO.Q
##	0	0
##	AE_PATIENTSTATUSINFO.C	AE_ATTENDEEFOOD.L
##	0	0
##	AE_ATTENDEEFOOD.Q	AE_ATTENDEEFOOD.C
##	0	0
##	DOC_TREATMENTEXPLANATION.L	DOC_TREATMENTEXPLANATION.Q
##	0	0
##	DOC_TREATMENTEXPLANATION.C	DOC_ATTITUDE.L
##	0	0
##	DOC_ATTITUDE.Q	DOC_ATTITUDE.C
##	0	0
##	DOC_VISITS.L	DOC_VISITS.Q
##	0	0
##	DOC_VISITS.C	DOC_TREATMENTEFFECTIVENESS.L
##	0	-Inf
##	DOC_TREATMENTEFFECTIVENESS.Q	DOC_TREATMENTEFFECTIVENESS.C
##	Inf	-Inf
##	NS_CALLBELLRESPONSE.L	NS_CALLBELLRESPONSE.Q
##	0	0
##	NS_CALLBELLRESPONSE.C	NS_NURSESATTITUDE.L
##	0	0
##	NS_NURSESATTITUDE.Q	NS_NURSESATTITUDE.C
##	0	0
##	NS_NURSEPROACTIVENESS.L	NS_NURSEPROACTIVENESS.Q
##	0	0

```

##          NS_NURSEPROACTIVENESS.C          NS_NURSEPATIENCE.L
##          0                                0
##          NS_NURSEPATIENCE.Q          NS_NURSEPATIENCE.C
##          0                                0
##          OVS_OVERALLSTAFFATTITUDE.L      OVS_OVERALLSTAFFATTITUDE.Q
##                               -Inf           Inf
##          OVS_OVERALLSTAFFATTITUDE.C      OVS_OVERALLSTAFFPROMPTNESS.L
##                               -Inf           0
##          OVS_OVERALLSTAFFPROMPTNESS.Q    OVS_OVERALLSTAFFPROMPTNESS.C
##          0                                0
##          OVS_SECURITYATTITUDE.L        OVS_SECURITYATTITUDE.Q
##          0                                0
##          OVS_SECURITYATTITUDE.C        DP_DISCHARGETIME.L
##          0                                0
##          DP_DISCHARGETIME.Q          DP_DISCHARGETIME.C
##          0                                0
##          DP_DISCHARGEQUERIES.L        DP_DISCHARGEQUERIES.Q
##          0                                0
##          DP_DISCHARGEQUERIES.C        DP_DISCHARGEPROCESS.L
##          0                                0
##          DP_DISCHARGEPROCESS.Q        DP_DISCHARGEPROCESS.C
##          0                                0
##          LengthofStay
##          0
## 0: finite value, Inf: infinity, -Inf: -infinity

```

These are the variables that are leading to quasi-complete separation where the coefficients are Infinity:

**CE_NPS, MaritalStatus, BedCategory, State, Country, DOC_TREATMENT
OVS_OVERALLSTAFFATTITUDE**

Part 5

Orthogonal polynomial coding is a form of trend analysis in that it is looking for the linear, quadratic and cubic trends in the categorical variable. This type of coding system should be used only with an ordinal variable in which the levels are equally spaced.

Part 6

```

options(scipen = 99)

Model_GLM = glm(NPS_Status ~ . - CE_NPS - MaritalStatus - BedCategory - State -
                 Country - DOC_TREATMENTEFFECTIVENESS - OVS_OVERALLSTAFFATTITUDE, data = Train,
                 family = binomial)

```

```
summary(Model_GLM)
```

```
##  
## Call:  
## glm(formula = NPS_Status ~ . - CE_NPS - MaritalStatus - BedCategory -  
##      State - Country - DOC_TREATMENTEFFECTIVENESS - OVS_OVERALLSTAFFATTITUDE,  
##      family = binomial, data = Train)  
##  
## Deviance Residuals:  
##      Min        1Q     Median       3Q      Max  
## -2.6238  -0.3716  -0.2002  -0.1029   3.3161  
##  
## Coefficients:  
##  
##              Estimate Std. Error z value  
## (Intercept) 3.5540234569 1.4451356160 2.459  
## AgeYrs       0.0068070088 0.0039542729 1.721  
## SexM         0.0582772907 0.1413678678 0.412  
## DepartmentGEN 0.1694975745 0.3006888827 0.564  
## DepartmentGYNAEC -0.3055031791 0.4089699692 -0.747  
## DepartmentORTHO -0.1135418772 0.3898294540 -0.291  
## DepartmentPEDIATRIC 0.2628469887 0.3886091009 0.676  
## DepartmentRENAL -0.4798587653 0.4737180508 -1.013  
## DepartmentSPECIAL -0.2018403297 0.3399454080 -0.594  
## Estimatedcost -0.0000007976 0.0000009885 -0.807  
## InsPayorcategoryEXEMPTION -0.5721055225 0.3774082873 -1.516  
## InsPayorcategoryINSURANCE -0.5330031245 0.2715128284 -1.963  
## InsPayorcategoryINTERNATIONAL 0.2121097562 0.9549169080 0.222  
## InsPayorcategoryPATIENT -0.1329657595 0.2663107841 -0.499  
## STATEZONEEAST -1.8106758625 1.0708568225 -1.691  
## STATEZONEINTERNATIONAL -1.9995993545 1.3876169842 -1.441  
## STATEZONENORTH -0.6920135501 1.2503113495 -0.553  
## STATEZONESOUTH -1.5286405012 1.0387904299 -1.472  
## STATEZONEUnknown -2.2709212642 1.2388696526 -1.833  
## STATEZONEWEST -2.3244388532 1.5683885207 -1.482  
## CE_ACCESSIBILITY.L -1.4395764992 0.6591918031 -2.184  
## CE_ACCESSIBILITY.Q -0.0655180048 0.5115843227 -0.128  
## CE_ACCESSIBILITY.C 0.5878398526 0.2841125336 2.069  
## CE_CSAT.L -2.0106253900 0.5763409433 -3.489  
## CE_CSAT.Q -0.5408398085 0.4547142476 -1.189  
## CE_CSAT.C 0.8849338934 0.2739196189 3.231  
## CE_VALUEFORMONEY.L -2.8088758392 0.4248385296 -6.612  
## CE_VALUEFORMONEY.Q 0.7128560830 0.3408342306 2.092  
## CE_VALUEFORMONEY.C 0.0017695964 0.1835611516 0.010  
## EM_IMMEDIATEATTENTION.L 0.7083680696 0.7671425876 0.923  
## EM_IMMEDIATEATTENTION.Q -0.9505278950 0.5539630180 -1.716  
## EM_IMMEDIATEATTENTION.C 0.6608090205 0.3640660970 1.815  
## EM_NURSING.L -1.5505863401 1.0447765684 -1.484  
## EM_NURSING.Q 0.5521703745 0.7588508884 0.728  
## EM_NURSING.C -0.2327690642 0.4685169390 -0.497  
## EM_DOCTOR.L 1.3833056657 1.3101802655 1.056  
## EM_DOCTOR.Q -0.9377713023 0.9206076670 -1.019  
## EM_DOCTOR.C -0.1469387862 0.5160442271 -0.285  
## EM_OVERALL.L -1.1561504962 1.0127633889 -1.142
```

## EM_OVERALL.Q	1.8731980584	0.6974475933	2.686
## EM_OVERALL.C	-1.0837829096	0.4215339272	-2.571
## AD_TIME.L	0.2870325341	0.2975066152	0.965
## AD_TIME.Q	0.3228760105	0.2320506273	1.391
## AD_TIME.C	-0.2126548624	0.2029782387	-1.048
## AD_TARIFFPACKAGESEXPLAINATION.L	-0.5019394664	0.3333692776	-1.506
## AD_TARIFFPACKAGESEXPLAINATION.Q	0.0111223519	0.2552486497	0.044
## AD_TARIFFPACKAGESEXPLAINATION.C	0.0861043511	0.1869984837	0.460
## AD_STAFFATTITUDE.L	-0.4231943146	0.4878795942	-0.867
## AD_STAFFATTITUDE.Q	-0.0259887970	0.3596117733	-0.072
## AD_STAFFATTITUDE.C	0.0122856108	0.2471137632	0.050
## INR_ROOMCLEANLINESS.L	-0.3748347253	0.3686226005	-1.017
## INR_ROOMCLEANLINESS.Q	-0.0852065585	0.2722833430	-0.313
## INR_ROOMCLEANLINESS.C	0.1666012894	0.1937903763	0.860
## INR_ROOMPEACE.L	-0.4981077121	0.3084426167	-1.615
## INR_ROOMPEACE.Q	0.4391877694	0.2353701318	1.866
## INR_ROOMPEACE.C	-0.3441596357	0.1910029647	-1.802
## INR_ROOMEQUIPMENT.L	-0.0220028198	0.4865595324	-0.045
## INR_ROOMEQUIPMENT.Q	0.3867011080	0.3748548556	1.032
## INR_ROOMEQUIPMENT.C	-0.0319036808	0.2413045229	-0.132
## INR_ROOMAMBIENCE.L	-0.0800092259	0.4331535193	-0.185
## INR_ROOMAMBIENCE.Q	0.1604265406	0.2990907359	0.536
## INR_ROOMAMBIENCE.C	0.1430008924	0.2044349638	0.699
## FNB_FOODQUALITY.L	-0.5101581544	0.3316440704	-1.538
## FNB_FOODQUALITY.Q	0.0295652208	0.2432044451	0.122
## FNB_FOODQUALITY.C	-0.1017209451	0.1622745992	-0.627
## FNB_FOODDELIVERYTIME.L	-0.7647519107	0.3311738244	-2.309
## FNB_FOODDELIVERYTIME.Q	0.1910457699	0.2439179758	0.783
## FNB_FOODDELIVERYTIME.C	-0.1308921277	0.1808165242	-0.724
## FNB_DIETICIAN.L	0.5038993893	0.4106288583	1.227
## FNB_DIETICIAN.Q	-0.3136447196	0.2930422119	-1.070
## FNB_DIETICIAN.C	-0.2220449908	0.1999373751	-1.111
## FNB_STAFFATTITUDE.L	1.2268178317	0.7400338584	1.658
## FNB_STAFFATTITUDE.Q	-1.4584216988	0.5535076647	-2.635
## FNB_STAFFATTITUDE.C	0.7670788059	0.3143016122	2.441
## AE_ATTENDEECARE.L	-0.4341318901	0.4901956861	-0.886
## AE_ATTENDEECARE.Q	0.2395913489	0.3623350892	0.661
## AE_ATTENDEECARE.C	-0.2171929149	0.2537239154	-0.856
## AE_PATIENTSTATUSINFO.L	0.0859699946	0.6142474887	0.140
## AE_PATIENTSTATUSINFO.Q	-0.2998273514	0.4542900337	-0.660
## AE_PATIENTSTATUSINFO.C	0.5390045112	0.2846631389	1.893
## AE_ATTENDEEFOOD.L	0.2536586082	0.3362870496	0.754
## AE_ATTENDEEFOOD.Q	-0.5250772392	0.2426731334	-2.164
## AE_ATTENDEEFOOD.C	-0.0614039599	0.1690990394	-0.363
## DOC_TREATMENTEXPLAINATION.L	-0.6106655158	0.8728743863	-0.700
## DOC_TREATMENTEXPLAINATION.Q	0.2848809264	0.6285434823	0.453
## DOC_TREATMENTEXPLAINATION.C	-0.3008848058	0.4076902425	-0.738
## DOC_ATTITUDE.L	0.1181371054	1.3545276795	0.087
## DOC_ATTITUDE.Q	-0.0899593004	0.9106542816	-0.099
## DOC_ATTITUDE.C	0.1563015084	0.4894688259	0.319
## DOC_VISITS.L	-1.5840368782	0.7040883677	-2.250
## DOC_VISITS.Q	0.5809499692	0.5042343992	1.152
## DOC_VISITS.C	0.0058846762	0.2957517341	0.020
## NS_CALLBELLRESPONSE.L	0.0256963086	0.4541333422	0.057

## NS_CALLBELLRESPONSE.Q	0.3285121491	0.3661164241	0.897
## NS_CALLBELLRESPONSE.C	-0.1809927474	0.3022269681	-0.599
## NS_NURSESATTITUDE.L	-0.6552139156	1.3447638552	-0.487
## NS_NURSESATTITUDE.Q	0.4626742671	1.0022381830	0.462
## NS_NURSESATTITUDE.C	0.2676896647	0.5611263217	0.477
## NS_NURSEPROACTIVENESS.L	0.0226318368	1.0549225096	0.021
## NS_NURSEPROACTIVENESS.Q	-0.0303347039	0.8140318341	-0.037
## NS_NURSEPROACTIVENESS.C	0.0029353963	0.4392235369	0.007
## NS_NURSEPATIENCE.L	-0.9944880822	1.1445720942	-0.869
## NS_NURSEPATIENCE.Q	1.1223541931	0.8293597288	1.353
## NS_NURSEPATIENCE.C	-0.6054534859	0.4751440582	-1.274
## OVS_OVERALLSTAFFPROMPTNESS.L	-0.0578174334	0.5993923972	-0.096
## OVS_OVERALLSTAFFPROMPTNESS.Q	-0.1936044712	0.4700450438	-0.412
## OVS_OVERALLSTAFFPROMPTNESS.C	-0.1245676721	0.3259930555	-0.382
## OVS_SECURITYATTITUDE.L	-0.0471561817	0.5738492921	-0.082
## OVS_SECURITYATTITUDE.Q	0.5718418365	0.4490845287	1.273
## OVS_SECURITYATTITUDE.C	-0.0443368692	0.3084938290	-0.144
## DP_DISCHARGETIME.L	-0.4782231393	0.4148396172	-1.153
## DP_DISCHARGETIME.Q	-0.4289566916	0.2756787870	-1.556
## DP_DISCHARGETIME.C	0.0717489378	0.1826548404	0.393
## DP_DISCHARGEQUERIES.L	0.1223314084	0.4684050009	0.261
## DP_DISCHARGEQUERIES.Q	-0.7600815835	0.3018738684	-2.518
## DP_DISCHARGEQUERIES.C	0.0060668668	0.2270496052	0.027
## DP_DISCHARGEPROCESS.L	-0.2718091596	0.5269959846	-0.516
## DP_DISCHARGEPROCESS.Q	0.3948465053	0.3105553589	1.271
## DP_DISCHARGEPROCESS.C	-0.1547391175	0.2190741532	-0.706
## LengthofStay	-0.0046376274	0.0141107412	-0.329
##	Pr(> z)		
## (Intercept)	0.013921 *		
## AgeYrs	0.085173 .		
## SexM	0.680165		
## DepartmentGEN	0.572960		
## DepartmentGYNAEC	0.455060		
## DepartmentORTHO	0.770852		
## DepartmentPEDIATRIC	0.498800		
## DepartmentRENAL	0.311078		
## DepartmentSPECIAL	0.552684		
## Estimatedcost	0.419721		
## InsPayorcategoryEXEMPTION	0.129550		
## InsPayorcategoryINSURANCE	0.049636 *		
## InsPayorcategoryINTERNATIONAL	0.824218		
## InsPayorcategoryPATIENT	0.617577		
## STATEZONEEAST	0.090862 .		
## STATEZONEINTERNATIONAL	0.149576		
## STATEZONENORTH	0.579940		
## STATEZONESOUTH	0.141140		
## STATEZONEUnknown	0.066794 .		
## STATEZONEWEST	0.138326		
## CE_ACCESSIBILITY.L	0.028973 *		
## CE_ACCESSIBILITY.Q	0.898095		
## CE_ACCESSIBILITY.C	0.038542 *		
## CE_CSAT.L	0.000486 ***		
## CE_CSAT.Q	0.234280		
## CE_CSAT.C	0.001235 **		

## CE_VALUEFORMONEY.L	0.000000000038 ***
## CE_VALUEFORMONEY.Q	0.036483 *
## CE_VALUEFORMONEY.C	0.992308
## EM_IMMEDIATEATTENTION.L	0.355807
## EM_IMMEDIATEATTENTION.Q	0.086186 .
## EM_IMMEDIATEATTENTION.C	0.069512 .
## EM_NURSING.L	0.137774
## EM_NURSING.Q	0.466834
## EM_NURSING.C	0.619315
## EM_DOCTOR.L	0.291054
## EM_DOCTOR.Q	0.308372
## EM_DOCTOR.C	0.775843
## EM_OVERALL.L	0.253629
## EM_OVERALL.Q	0.007236 **
## EM_OVERALL.C	0.010139 *
## AD_TIME.L	0.334648
## AD_TIME.Q	0.164103
## AD_TIME.C	0.294789
## AD_TARIFFPACKAGESEXPLAINATION.L	0.132155
## AD_TARIFFPACKAGESEXPLAINATION.Q	0.965244
## AD_TARIFFPACKAGESEXPLAINATION.C	0.645190
## AD_STAFFATTITUDE.L	0.385714
## AD_STAFFATTITUDE.Q	0.942388
## AD_STAFFATTITUDE.C	0.960348
## INR_ROOMCLEANLINESS.L	0.309224
## INR_ROOMCLEANLINESS.Q	0.754331
## INR_ROOMCLEANLINESS.C	0.389955
## INR_ROOMPEACE.L	0.106330
## INR_ROOMPEACE.Q	0.062049 .
## INR_ROOMPEACE.C	0.071568 .
## INR_ROOMEQUIPMENT.L	0.963931
## INR_ROOMEQUIPMENT.Q	0.302258
## INR_ROOMEQUIPMENT.C	0.894816
## INR_ROOMAMBIENCE.L	0.853454
## INR_ROOMAMBIENCE.Q	0.591695
## INR_ROOMAMBIENCE.C	0.484244
## FNB_FOODQUALITY.L	0.123983
## FNB_FOODQUALITY.Q	0.903243
## FNB_FOODQUALITY.C	0.530761
## FNB_FOODDELIVERYTIME.L	0.020932 *
## FNB_FOODDELIVERYTIME.Q	0.433488
## FNB_FOODDELIVERYTIME.C	0.469130
## FNB_DIETICIAN.L	0.219770
## FNB_DIETICIAN.Q	0.284482
## FNB_DIETICIAN.C	0.266752
## FNB_STAFFATTITUDE.L	0.097361 .
## FNB_STAFFATTITUDE.Q	0.008417 **
## FNB_STAFFATTITUDE.C	0.014664 *
## AE_ATTENDEECARE.L	0.375817
## AE_ATTENDEECARE.Q	0.508457
## AE_ATTENDEECARE.C	0.391986
## AE_PATIENTSTATUSINFO.L	0.888692
## AE_PATIENTSTATUSINFO.Q	0.509260
## AE_PATIENTSTATUSINFO.C	0.058294 .

```

## AE_ATTENDEEFOOD.L          0.450674
## AE_ATTENDEEFOOD.Q          0.030486 *
## AE_ATTENDEEFOOD.C          0.716512
## DOC_TREATMENTEXPLAINATION.L 0.484175
## DOC_TREATMENTEXPLAINATION.Q 0.650376
## DOC_TREATMENTEXPLAINATION.C 0.460500
## DOC_ATTITUDE.L             0.930499
## DOC_ATTITUDE.Q             0.921309
## DOC_ATTITUDE.C             0.749477
## DOC_VISITS.L               0.024464 *
## DOC_VISITS.Q               0.249262
## DOC_VISITS.C               0.984125
## NS_CALLBELLRESPONSE.L       0.954877
## NS_CALLBELLRESPONSE.Q       0.369565
## NS_CALLBELLRESPONSE.C       0.549264
## NS_NURSESATTITUDE.L         0.626093
## NS_NURSESATTITUDE.Q         0.644339
## NS_NURSESATTITUDE.C         0.633321
## NS_NURSEPROACTIVENESS.L     0.982884
## NS_NURSEPROACTIVENESS.Q     0.970274
## NS_NURSEPROACTIVENESS.C     0.994668
## NS_NURSEPATIENCE.L          0.384916
## NS_NURSEPATIENCE.Q          0.175967
## NS_NURSEPATIENCE.C          0.202574
## OVS_OVERALLSTAFFPROMPTNESS.L 0.923155
## OVS_OVERALLSTAFFPROMPTNESS.Q 0.680424
## OVS_OVERALLSTAFFPROMPTNESS.C 0.702374
## OVS_SECURITYATTITUDE.L       0.934507
## OVS_SECURITYATTITUDE.Q       0.202894
## OVS_SECURITYATTITUDE.C       0.885721
## DP_DISCHARGETIME.L          0.248996
## DP_DISCHARGETIME.Q          0.119708
## DP_DISCHARGETIME.C          0.694459
## DP_DISCHARGEQUERIES.L        0.793965
## DP_DISCHARGEQUERIES.Q        0.011806 *
## DP_DISCHARGEQUERIES.C        0.978683
## DP_DISCHARGEPROCESS.L        0.606014
## DP_DISCHARGEPROCESS.Q        0.203579
## DP_DISCHARGEPROCESS.C        0.479982
## LengthofStay                 0.742413
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
## Null deviance: 2829.2  on 4272  degrees of freedom
## Residual deviance: 1701.8  on 4153  degrees of freedom
## AIC: 1941.8
##
## Number of Fisher Scoring iterations: 7

```

```
Model_GLM = step(Model_GLM)
```

```
## Start:  AIC=1941.78
```

```

## NPS_Status ~ (MaritalStatus + AgeYrs + Sex + BedCategory + Department +
## Estimatedcost + InsPayorcategory + State + Country + STATEZONE +
## CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
## EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARIFFPACKAGESEXPLAINATION +
## AD_STAFFATTITUDE + INR_ROOMCLEANLINESS + INR_ROOMPEACE +
## INR_ROOMEQUIPMENT + INR_ROOMAMBIENCE + FNB_FOODQUALITY +
## FNB_FOODDELIVERYTIME + FNB_DIETICIAN + FNB_STAFFATTITUDE +
## AE_ATTENDEECARE + AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD +
## DOC_TREATMENTEXPLAINATION + DOC_ATTITUDE + DOC_VISITS + DOC_TREATMENTEFFECTIVENESS +
## NS_CALLBELLRESPONSE + NS_NURSESATTITUDE + NS_NURSEPROACTIVENESS +
## NS_NURSEPATIENCE + OVS_OVERALLSTAFFATTITUDE + OVS_OVERALLSTAFFPROMPTNESS +
## OVS_SECURITYATTITUDE + DP_DISCHARGETIME + DP_DISCHARGEQUERIES +
## DP_DISCHARGEPROCESS + LengthofStay + CE_NPS) - CE_NPS - MaritalStatus -
## BedCategory - State - Country - DOC_TREATMENTEFFECTIVENESS -
## OVS_OVERALLSTAFFATTITUDE
##
##                                     Df Deviance    AIC
## - NS_NURSEPROACTIVENESS          3 1701.8 1935.8
## - DOC_ATTITUDE                   3 1702.0 1936.0
## - STATEZONE                      6 1708.2 1936.2
## - AE_ATTENDEECARE                3 1703.0 1937.0
## - NS_CALLBELLRESPONSE             3 1703.0 1937.0
## - Department                     6 1709.1 1937.1
## - DOC_TREATMENTEXPLAINATION      3 1703.3 1937.3
## - INR_ROOMAMBIENCE                3 1703.4 1937.4
## - DP_DISCHARGEPROCESS              3 1703.5 1937.5
## - AD_STAFFATTITUDE                 3 1703.6 1937.6
## - OVS_OVERALLSTAFFPROMPTNESS      3 1703.8 1937.8
## - NS_NURSEPATIENCE                  3 1704.0 1938.0
## - INR_ROOMEQUIPMENT                 3 1704.2 1938.2
## - FNB_FOODQUALITY                   3 1704.3 1938.3
## - INR_ROOMCLEANLINESS               3 1704.5 1938.5
## - AD_TARIFFPACKAGESEXPLAINATION     3 1704.9 1938.9
## - EM_NURSING                        3 1705.3 1939.3
## - NS_NURSESATTITUDE                  3 1705.4 1939.4
## - EM_IMMEDIATEATTENTION              3 1705.7 1939.7
## - LengthofStay                      1 1701.9 1939.9
## - Sex                                1 1702.0 1940.0
## - AD_TIME                            3 1706.1 1940.1
## - AE_PATIENTSTATUSINFO                3 1706.4 1940.4
## - Estimatedcost                      1 1702.5 1940.5
## - DP_DISCHARGETIME                    3 1706.5 1940.5
## - EM_DOCTOR                           3 1706.9 1940.9
## - FNB_FOODDELIVERYTIME                 3 1707.2 1941.2
## - INR_ROOMPEACE                       3 1707.4 1941.4
## - OVS_SECURITYATTITUDE                  3 1707.6 1941.6
## - FNB_DIETICIAN                      3 1707.8 1941.8
## <none>                               1701.8 1941.8
## - AE_ATTENDEEFOOD                     3 1708.0 1942.0
## - AgeYrs                             1 1704.8 1942.8
## - DOC_VISITS                          3 1709.2 1943.2
## - InsPayorcategory                    4 1711.4 1943.4
## - FNB_STAFFATTITUDE                   3 1711.1 1945.1
## - EM_OVERALL                          3 1712.1 1946.1

```

```

## - DP_DISCHARGEQUERIES            3  1713.4 1947.4
## - CE_ACCESSIBILITY              3  1734.3 1968.3
## - CE_CSAT                         3  1766.1 2000.1
## - CE_VALUEFORMONEY               3  1782.0 2016.0
##
## Step: AIC=1935.78
## NPS_Status ~ AgeYrs + Sex + Department + Estimatedcost + InsPayorcategory +
##           STATEZONE + CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY +
##           EM_IMMEDIATEATTENTION + EM_NURSING + EM_DOCTOR + EM_OVERALL +
##           AD_TIME + AD_TARRIFFPACKAGESEXPLAINATION + AD_STAFFATTITUDE +
##           INR_ROOMCLEANLINESS + INR_ROOMPEACE + INR_ROOMEQUIPMENT +
##           INR_ROOMAMBIENCE + FNB_FOODQUALITY + FNB_FOODDELIVERYTIME +
##           FNB_DIETICIAN + FNB_STAFFATTITUDE + AE_ATTENDEECARE + AE_PATIENTSTATUSINFO +
##           AE_ATTENDEEFOOD + DOC_TREATMENTEXPLAINATION + DOC_ATTITUDE +
##           DOC_VISITS + NS_CALLBELLRESPONSE + NS_NURSESATTITUDE + NS_NURSEPATIENCE +
##           OVS_OVERALLSTAFFPROMPTNESS + OVS_SECURITYATTITUDE + DP_DISCHARGETIME +
##           DP_DISCHARGEQUERIES + DP_DISCHARGEPROCESS + LengthofStay
##
##                                         Df Deviance     AIC
## - DOC_ATTITUDE                      3  1702.0 1930.0
## - STATEZONE                         6  1708.3 1930.3
## - AE_ATTENDEECARE                   3  1703.0 1931.0
## - NS_CALLBELLRESPONSE                3  1703.0 1931.0
## - Department                        6  1709.1 1931.1
## - DOC_TREATMENTEXPLAINATION        3  1703.3 1931.3
## - INR_ROOMAMBIENCE                  3  1703.4 1931.4
## - DP_DISCHARGEPROCESS                3  1703.5 1931.5
## - AD_STAFFATTITUDE                  3  1703.6 1931.6
## - OVS_OVERALLSTAFFPROMPTNESS       3  1703.9 1931.9
## - NS_NURSEPATIENCE                  3  1704.1 1932.1
## - INR_ROOMEQUIPMENT                 3  1704.2 1932.2
## - FNB_FOODQUALITY                  3  1704.4 1932.4
## - INR_ROOMCLEANLINESS              3  1704.5 1932.5
## - AD_TARRIFFPACKAGESEXPLAINATION   3  1704.9 1932.9
## - EM_NURSING                        3  1705.3 1933.3
## - NS_NURSESATTITUDE                 3  1705.5 1933.5
## - EM_IMMEDIATEATTENTION            3  1705.8 1933.8
## - LengthofStay                      1  1701.9 1933.9
## - Sex                               1  1702.0 1934.0
## - AD_TIME                           3  1706.1 1934.1
## - AE_PATIENTSTATUSINFO              3  1706.5 1934.5
## - Estimatedcost                     1  1702.5 1934.5
## - DP_DISCHARGETIME                  3  1706.5 1934.5
## - EM_DOCTOR                          3  1706.9 1934.9
## - FNB_FOODDELIVERYTIME              3  1707.3 1935.3
## - INR_ROOMPEACE                      3  1707.4 1935.4
## - OVS_SECURITYATTITUDE               3  1707.6 1935.6
## <none>                             1701.8 1935.8
## - FNB_DIETICIAN                     3  1707.9 1935.9
## - AE_ATTENDEEFOOD                   3  1708.0 1936.0
## - AgeYrs                            1  1704.8 1936.8
## - DOC_VISITS                         3  1709.3 1937.3
## - InsPayorcategory                  4  1711.4 1937.4
## - FNB_STAFFATTITUDE                  3  1711.2 1939.2

```

```

## - EM_OVERALL                      3  1712.1 1940.1
## - DP_DISCHARGEQUERIES              3  1713.5 1941.5
## - CE_ACCESSIBILITY                 3  1734.4 1962.4
## - CE_CSAT                          3  1766.4 1994.4
## - CE_VALUEFORMONEY                 3  1782.7 2010.7
##
## Step: AIC=1930.02
## NPS_Status ~ AgeYrs + Sex + Department + Estimatedcost + InsPayorcategory +
## STATEZONE + CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY +
## EM_IMMEDIATEATTENTION + EM_NURSING + EM_DOCTOR + EM_OVERALL +
## AD_TIME + AD_TARRIFFPACKAGESEXPLAINATION + AD_STAFFATTITUDE +
## INR_ROOMCLEANLINESS + INR_ROOMPEACE + INR_ROOMEQUIPMENT +
## INR_ROOMAMBIENCE + FNB_FOODQUALITY + FNB_FOODDELIVERYTIME +
## FNB_DIETICIAN + FNB_STAFFATTITUDE + AE_ATTENDEECARE + AE_PATIENTSTATUSINFO +
## AE_ATTENDEEFOOD + DOC_TREATMENTEXPLAINATION + DOC_VISITS +
## NS_CALLBELLRESPONSE + NS_NURSESATTITUDE + NS_NURSEPATIENCE +
## OVS_OVERALLSTAFFPROMPTNESS + OVS_SECURITYATTITUDE + DP_DISCHARGETIME +
## DP_DISCHARGEQUERIES + DP_DISCHARGEPROCESS + LengthofStay
##
##                                     Df Deviance    AIC
## - STATEZONE                      6  1708.7 1924.7
## - AE_ATTENDEECARE                3  1703.3 1925.3
## - NS_CALLBELLRESPONSE             3  1703.3 1925.3
## - Department                     6  1709.4 1925.4
## - DOC_TREATMENTEXPLAINATION      3  1703.4 1925.4
## - INR_ROOMAMBIENCE               3  1703.6 1925.6
## - AD_STAFFATTITUDE                3  1703.8 1925.8
## - DP_DISCHARGEPROCESS             3  1703.8 1925.8
## - OVS_OVERALLSTAFFPROMPTNESS     3  1704.2 1926.2
## - NS_NURSEPATIENCE                3  1704.3 1926.3
## - INR_ROOMEQUIPMENT               3  1704.5 1926.5
## - FNB_FOODQUALITY                 3  1704.7 1926.7
## - INR_ROOMCLEANLINESS             3  1704.9 1926.9
## - AD_TARRIFFPACKAGESEXPLAINATION 3  1705.2 1927.2
## - EM_NURSING                      3  1705.5 1927.5
## - NS_NURSESATTITUDE                3  1705.9 1927.9
## - EM_IMMEDIATEATTENTION            3  1706.0 1928.0
## - LengthofStay                    1  1702.1 1928.1
## - Sex                             1  1702.2 1928.2
## - AD_TIME                         3  1706.3 1928.3
## - Estimatedcost                   1  1702.7 1928.7
## - AE_PATIENTSTATUSINFO            3  1706.7 1928.7
## - DP_DISCHARGETIME                 3  1706.8 1928.8
## - EM_DOCTOR                        3  1707.2 1929.2
## - FNB_FOODDELIVERYTIME             3  1707.6 1929.6
## - INR_ROOMPEACE                    3  1707.6 1929.6
## - OVS_SECURITYATTITUDE              3  1707.9 1929.9
## <none>                            1702.0 1930.0
## - FNB_DIETICIAN                   3  1708.0 1930.0
## - AE_ATTENDEEFOOD                  3  1708.2 1930.2
## - AgeYrs                           1  1705.1 1931.1
## - InsPayorcategory                 4  1711.6 1931.6
## - DOC_VISITS                       3  1710.7 1932.7
## - FNB_STAFFATTITUDE                 3  1711.5 1933.5

```

```

## - EM_OVERALL                      3  1712.3 1934.3
## - DP_DISCHARGEQUERIES              3  1713.7 1935.7
## - CE_ACCESSIBILITY                 3  1735.0 1957.0
## - CE_CSAT                          3  1767.2 1989.2
## - CE_VALUEFORMONEY                 3  1783.0 2005.0
##
## Step: AIC=1924.65
## NPS_Status ~ AgeYrs + Sex + Department + Estimatedcost + InsPayorcategory +
##   CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##   EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARRIFFPACKAGESEXPLAINATION +
##   AD_STAFFATTITUDE + INR_ROOMCLEANLINESS + INR_ROOMPEACE +
##   INR_ROOMEQUIPMENT + INR_ROOMAMBIENCE + FNB_FOODQUALITY +
##   FNB_FOODDELIVERYTIME + FNB_DIETICIAN + FNB_STAFFATTITUDE +
##   AE_ATTENDEECARE + AE_PATIENTSTATUSINFO + AE_ATTENDEEFOD +
##   DOC_TREATMENTEXPLAINATION + DOC_VISITS + NS_CALLBELLRESPONSE +
##   NS_NURSESATTITUDE + NS_NURSEPATIENCE + OVS_OVERALLSTAFFPROMPTNESS +
##   OVS_SECURITYATTITUDE + DP_DISCHARGETIME + DP_DISCHARGEQUERIES +
##   DP_DISCHARGEPROCESS + LengthofStay
##
##                                         Df Deviance    AIC
## - NS_CALLBELLRESPONSE                3  1709.8 1919.8
## - AE_ATTENDEECARE                   3  1710.0 1920.0
## - DOC_TREATMENTEXPLAINATION         3  1710.1 1920.1
## - INR_ROOMAMBIENCE                  3  1710.3 1920.3
## - AD_STAFFATTITUDE                  3  1710.4 1920.4
## - DP_DISCHARGEPROCESS                3  1710.5 1920.5
## - Department                         6  1716.7 1920.7
## - OVS_OVERALLSTAFFPROMPTNESS        3  1710.7 1920.7
## - NS_NURSEPATIENCE                  3  1710.7 1920.7
## - INR_ROOMEQUIPMENT                 3  1710.9 1920.9
## - FNB_FOODQUALITY                   3  1711.0 1921.0
## - INR_ROOMCLEANLINESS               3  1711.4 1921.4
## - AD_TARRIFFPACKAGESEXPLAINATION    3  1711.7 1921.7
## - EM_NURSING                         3  1712.4 1922.4
## - EM_IMMEDIATEATTENTION              3  1712.6 1922.6
## - NS_NURSESATTITUDE                  3  1712.7 1922.7
## - LengthofStay                       1  1708.8 1922.8
## - AE_PATIENTSTATUSINFO               3  1712.8 1922.8
## - Sex                                1  1708.8 1922.8
## - AD_TIME                            3  1712.8 1922.8
## - Estimatedcost                      1  1709.5 1923.5
## - DP_DISCHARGETIME                   3  1713.5 1923.5
## - EM_DOCTOR                           3  1713.7 1923.7
## - INR_ROOMPEACE                      3  1714.2 1924.2
## - OVS_SECURITYATTITUDE                3  1714.3 1924.3
## - FNB_FOODDELIVERYTIME                3  1714.4 1924.4
## <none>                               1708.7 1924.7
## - AE_ATTENDEEFOD                     3  1714.8 1924.8
## - FNB_DIETICIAN                      3  1715.1 1925.1
## - InsPayorcategory                   4  1717.6 1925.6
## - AgeYrs                             1  1711.6 1925.6
## - FNB_STAFFATTITUDE                  3  1718.3 1928.3
## - DOC_VISITS                          3  1718.6 1928.6
## - EM_OVERALL                          3  1719.1 1929.1

```

```

## - DP_DISCHARGEQUERIES            3  1720.1 1930.1
## - CE_ACCESSIBILITY              3  1742.4 1952.4
## - CE_CSAT                         3  1772.6 1982.6
## - CE_VALUEFORMONEY               3  1789.4 1999.4
##
## Step: AIC=1919.81
## NPS_Status ~ AgeYrs + Sex + Department + Estimatedcost + InsPayorcategory +
##   CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##   EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARIFFPACKAGESEXPLAINATION +
##   AD_STAFFATTITUDE + INR_ROOMCLEANLINESS + INR_ROOMPEACE +
##   INR_ROOMEQUIPMENT + INR_ROOMAMBIENCE + FNB_FOODQUALITY +
##   FNB_FOODDELIVERYTIME + FNB_DIETICIAN + FNB_STAFFATTITUDE +
##   AE_ATTENDEECARE + AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD +
##   DOC_TREATMENTEXPLAINATION + DOC_VISITS + NS_NURSESATTITUDE +
##   NS_NURSEPATIENCE + OVS_OVERALLSTAFFPROMPTNESS + OVS_SECURITYATTITUDE +
##   DP_DISCHARGETIME + DP_DISCHARGEQUERIES + DP_DISCHARGEPROCESS +
##   LengthofStay
##
##                                         Df Deviance    AIC
## - AE_ATTENDEECARE                  3  1711.0 1915.0
## - DOC_TREATMENTEXPLAINATION        3  1711.3 1915.3
## - INR_ROOMAMBIENCE                 3  1711.5 1915.5
## - AD_STAFFATTITUDE                 3  1711.5 1915.5
## - OVS_OVERALLSTAFFPROMPTNESS       3  1711.7 1915.7
## - DP_DISCHARGEPROCESS              3  1711.9 1915.9
## - NS_NURSEPATIENCE                 3  1711.9 1915.9
## - INR_ROOMEQUIPMENT                3  1712.0 1916.0
## - Department                       6  1718.1 1916.1
## - FNB_FOODQUALITY                  3  1712.4 1916.4
## - INR_ROOMCLEANLINESS              3  1712.5 1916.5
## - AD_TARIFFPACKAGESEXPLAINATION   3  1712.8 1916.8
## - EM_IMMEDIATEATTENTION            3  1713.7 1917.7
## - EM_NURSING                        3  1713.7 1917.7
## - AE_PATIENTSTATUSINFO              3  1713.9 1917.9
## - LengthofStay                      1  1709.9 1917.9
## - AD_TIME                           3  1713.9 1917.9
## - Sex                               1  1710.0 1918.0
## - EM_DOCTOR                          3  1714.6 1918.6
## - Estimatedcost                     1  1710.6 1918.6
## - DP_DISCHARGETIME                   3  1714.6 1918.6
## - INR_ROOMPEACE                      3  1715.1 1919.1
## - FNB_FOODDELIVERYTIME               3  1715.5 1919.5
## - OVS_SECURITYATTITUDE                3  1715.7 1919.7
## <none>                                1709.8 1919.8
## - AE_ATTENDEEFOOD                   3  1716.1 1920.1
## - NS_NURSESATTITUDE                  3  1716.2 1920.2
## - FNB_DIETICIAN                     3  1716.4 1920.4
## - InsPayorcategory                  4  1718.7 1920.7
## - AgeYrs                            1  1712.9 1920.9
## - DOC_VISITS                         3  1719.4 1923.4
## - FNB_STAFFATTITUDE                  3  1719.4 1923.4
## - EM_OVERALL                         3  1720.8 1924.8
## - DP_DISCHARGEQUERIES                 3  1721.7 1925.7
## - CE_ACCESSIBILITY                   3  1743.2 1947.2

```

```

## - CE_CSAT                      3  1773.0 1977.0
## - CE_VALUEFORMONEY              3  1793.0 1997.0
##
## Step: AIC=1915.05
## NPS_Status ~ AgeYrs + Sex + Department + Estimatedcost + InsPayorcategory +
##   CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##   EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARRIFFPACKAGESEXPLAINATION +
##   AD_STAFFATTITUDE + INR_ROOMCLEANLINESS + INR_ROOMPEACE +
##   INR_ROOMEQUIPMENT + INR_ROOMAMBIENCE + FNB_FOODQUALITY +
##   FNB_FOODDELIVERYTIME + FNB_DIETICIAN + FNB_STAFFATTITUDE +
##   AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD + DOC_TREATMENTEXPLAINATION +
##   DOC_VISITS + NS_NURSESATTITUDE + NS_NURSEPATIENCE + OVS_OVERALLSTAFFPROMPTNESS +
##   OVS_SECURITYATTITUDE + DP_DISCHARGETIME + DP_DISCHARGEQUERIES +
##   DP_DISCHARGEPROCESS + LengthofStay
##
##                                         Df Deviance    AIC
## - DOC_TREATMENTEXPLAINATION      3  1712.5 1910.5
## - INR_ROOMAMBIENCE               3  1712.6 1910.6
## - AD_STAFFATTITUDE                3  1712.8 1910.8
## - OVS_OVERALLSTAFFPROMPTNESS     3  1712.9 1910.9
## - NS_NURSEPATIENCE                 3  1713.0 1911.0
## - DP_DISCHARGEPROCESS             3  1713.2 1911.2
## - INR_ROOMEQUIPMENT               3  1713.3 1911.3
## - FNB_FOODQUALITY                  3  1713.5 1911.5
## - Department                      6  1719.6 1911.6
## - AD_TARRIFFPACKAGESEXPLAINATION 3  1714.1 1912.1
## - INR_ROOMCLEANLINESS             3  1714.2 1912.2
## - AE_PATIENTSTATUSINFO            3  1714.7 1912.7
## - EM_IMMEDIATEATTENTION           3  1715.0 1913.0
## - EM_NURSING                      3  1715.0 1913.0
## - LengthofStay                     1  1711.2 1913.2
## - AD_TIME                          3  1715.2 1913.2
## - Sex                             1  1711.3 1913.3
## - Estimatedcost                   1  1711.7 1913.7
## - EM_DOCTOR                        3  1716.0 1914.0
## - DP_DISCHARGETIME                  3  1716.0 1914.0
## - INR_ROOMPEACE                     3  1716.5 1914.5
## - FNB_FOODDELIVERYTIME              3  1716.9 1914.9
## <none>                            1711.0 1915.0
## - OVS_SECURITYATTITUDE              3  1717.1 1915.1
## - AE_ATTENDEEFOOD                   3  1717.3 1915.3
## - NS_NURSESATTITUDE                  3  1717.5 1915.5
## - InsPayorcategory                  4  1719.8 1915.8
## - FNB_DIETICIAN                     3  1717.9 1915.9
## - AgeYrs                           1  1714.2 1916.2
## - DOC_VISITS                         3  1720.6 1918.6
## - FNB_STAFFATTITUDE                  3  1720.7 1918.7
## - EM_OVERALL                         3  1722.4 1920.4
## - DP_DISCHARGEQUERIES                 3  1723.2 1921.2
## - CE_ACCESSIBILITY                   3  1744.5 1942.5
## - CE_CSAT                            3  1775.3 1973.3
## - CE_VALUEFORMONEY                   3  1796.5 1994.5
##
## Step: AIC=1910.46

```

```

## NPS_Status ~ AgeYrs + Sex + Department + Estimatedcost + InsPayorcategory +
##   CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##   EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARRIFFPACKAGESEXPLAINATION +
##   AD_STAFFATTITUDE + INR_ROOMCLEANLINESS + INR_ROOMPEACE +
##   INR_ROOMEQUIPMENT + INR_ROOMAMBIENCE + FNB_FOODQUALITY +
##   FNB_FOODDELIVERYTIME + FNB_DIETICIAN + FNB_STAFFATTITUDE +
##   AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD + DOC_VISITS + NS_NURSESATTITUDE +
##   NS_NURSEPATIENCE + OVS_OVERALLSTAFFPROMPTNESS + OVS_SECURITYATTITUDE +
##   DP_DISCHARGETIME + DP_DISCHARGEQUERIES + DP_DISCHARGEPROCESS +
##   LengthofStay
##
##                                     Df Deviance    AIC
## - INR_ROOMAMBIENCE            3  1713.9 1905.9
## - AD_STAFFATTITUDE            3  1714.3 1906.3
## - OVS_OVERALLSTAFFPROMPTNESS  3  1714.4 1906.4
## - NS_NURSEPATIENCE            3  1714.6 1906.6
## - DP_DISCHARGEPROCESS         3  1714.7 1906.7
## - FNB_FOODQUALITY             3  1714.9 1906.9
## - Department                  6  1721.0 1907.0
## - INR_ROOMEQUIPMENT           3  1715.0 1907.0
## - AD_TARRIFFPACKAGESEXPLAINATION 3  1715.5 1907.5
## - INR_ROOMCLEANLINESS          3  1715.9 1907.9
## - EM_IMMEDIATEATTENTION       3  1716.0 1908.0
## - AE_PATIENTSTATUSINFO        3  1716.3 1908.3
## - AD_TIME                      3  1716.4 1908.4
## - EM_NURSING                   3  1716.5 1908.5
## - LengthofStay                 1  1712.6 1908.6
## - Sex                          1  1712.7 1908.7
## - Estimatedcost                1  1713.2 1909.2
## - INR_ROOMPEACE                 3  1717.5 1909.5
## - DP_DISCHARGETIME              3  1717.5 1909.5
## - EM_DOCTOR                     3  1717.9 1909.9
## - OVS_SECURITYATTITUDE          3  1718.1 1910.1
## - FNB_FOODDELIVERYTIME          3  1718.2 1910.2
## - NS_NURSESATTITUDE              3  1718.3 1910.3
## - AE_ATTENDEEFOOD                3  1718.4 1910.4
## <none>                         1712.5 1910.5
## - FNB_DIETICIAN                 3  1719.5 1911.5
## - AgeYrs                        1  1715.6 1911.6
## - InsPayorcategory               4  1721.6 1911.6
## - FNB_STAFFATTITUDE              3  1721.8 1913.8
## - EM_OVERALL                     3  1723.4 1915.4
## - DP_DISCHARGEQUERIES             3  1724.5 1916.5
## - DOC_VISITS                     3  1727.5 1919.5
## - CE_ACCESSIBILITY                3  1746.4 1938.4
## - CE_CSAT                         3  1777.0 1969.0
## - CE_VALUEFORMONEY                 3  1797.2 1989.2
##
## Step: AIC=1905.9
## NPS_Status ~ AgeYrs + Sex + Department + Estimatedcost + InsPayorcategory +
##   CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##   EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARRIFFPACKAGESEXPLAINATION +
##   AD_STAFFATTITUDE + INR_ROOMCLEANLINESS + INR_ROOMPEACE +
##   INR_ROOMEQUIPMENT + FNB_FOODQUALITY + FNB_FOODDELIVERYTIME +

```

```

## FNB_DIETICIAN + FNB_STAFFATTITUDE + AE_PATIENTSTATUSINFO +
## AE_ATTENDEEFOOD + DOC_VISITS + NS_NURSESATTITUDE + NS_NURSEPATIENCE +
## OVS_OVERALLSTAFFPROMPTNESS + OVS_SECURITYATTITUDE + DP_DISCHARGETIME +
## DP_DISCHARGEQUERIES + DP_DISCHARGEPROCESS + LengthofStay
##
##                                     Df Deviance    AIC
## - AD_STAFFATTITUDE            3  1715.6 1901.6
## - OVS_OVERALLSTAFFPROMPTNESS  3  1716.0 1902.0
## - NS_NURSEPATIENCE            3  1716.1 1902.1
## - DP_DISCHARGEPROCESS         3  1716.3 1902.3
## - FNB_FOODQUALITY            3  1716.3 1902.3
## - Department                  6  1722.5 1902.5
## - AD_TARRIFFPACKAGESEXPLAINATION 3  1716.9 1902.9
## - EM_IMMEDIATEATTENTION      3  1717.3 1903.3
## - AD_TIME                     3  1717.6 1903.6
## - AE_PATIENTSTATUSINFO       3  1717.7 1903.7
## - LengthofStay                1  1714.0 1904.0
## - INR_ROOMEQUIPMENT          3  1718.1 1904.1
## - Sex                         1  1714.2 1904.2
## - EM_NURSING                  3  1718.2 1904.2
## - INR_ROOMCLEANLINESS         3  1718.5 1904.5
## - Estimatedcost               1  1714.6 1904.6
## - DP_DISCHARGETIME            3  1719.0 1905.0
## - AE_ATTENDEEFOOD             3  1719.3 1905.3
## - EM_DOCTOR                   3  1719.3 1905.3
## - OVS_SECURITYATTITUDE        3  1719.3 1905.3
## - INR_ROOMPEACE                3  1719.6 1905.6
## - NS_NURSESATTITUDE           3  1719.8 1905.8
## <none>                      1713.9 1905.9
## - FNB_FOODDELIVERYTIME        3  1719.9 1905.9
## - FNB_DIETICIAN               3  1720.6 1906.6
## - AgeYrs                      1  1717.0 1907.0
## - InsPayorcategory            4  1723.1 1907.1
## - FNB_STAFFATTITUDE           3  1723.2 1909.2
## - EM_OVERALL                   3  1724.3 1910.3
## - DP_DISCHARGEQUERIES          3  1726.3 1912.3
## - DOC_VISITS                   3  1729.1 1915.1
## - CE_ACCESSIBILITY             3  1747.7 1933.7
## - CE_CSAT                      3  1778.4 1964.4
## - CE_VALUEFORMONEY              3  1800.5 1986.5
##
## Step: AIC=1901.63
## NPS_Status ~ AgeYrs + Sex + Department + Estimatedcost + InsPayorcategory +
##             CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##             EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARRIFFPACKAGESEXPLAINATION +
##             INR_ROOMCLEANLINESS + INR_ROOMPEACE + INR_ROOMEQUIPMENT +
##             FNB_FOODQUALITY + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##             FNB_STAFFATTITUDE + AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD +
##             DOC_VISITS + NS_NURSESATTITUDE + NS_NURSEPATIENCE + OVS_OVERALLSTAFFPROMPTNESS +
##             OVS_SECURITYATTITUDE + DP_DISCHARGETIME + DP_DISCHARGEQUERIES +
##             DP_DISCHARGEPROCESS + LengthofStay
##
##                                     Df Deviance    AIC
## - OVS_OVERALLSTAFFPROMPTNESS  3  1717.6 1897.6

```

```

## - NS_NURSEPATIENCE            3  1717.9 1897.9
## - DP_DISCHARGEPROCESS        3  1718.1 1898.1
## - FNB_FOODQUALITY            3  1718.1 1898.1
## - Department                  6  1724.1 1898.1
## - AD_TIME                     3  1718.4 1898.4
## - EM_IMMEDIATEATTENTION      3  1719.0 1899.0
## - AE_PATIENTSTATUSINFO        3  1719.6 1899.6
## - INR_ROOMEQUIPMENT           3  1719.6 1899.6
## - LengthofStay                 1  1715.7 1899.7
## - Sex                          1  1715.9 1899.9
## - EM_NURSING                   3  1720.0 1900.0
## - INR_ROOMCLEANLINESS          3  1720.2 1900.2
## - Estimatedcost                1  1716.3 1900.3
## - AD_TARIFFPACKAGESEXPLAINATION 3  1720.5 1900.5
## - DP_DISCHARGETIME              3  1720.6 1900.6
## - AE_ATTENDEEFOOD               3  1720.7 1900.7
## - OVS_SECURITYATTITUDE          3  1721.0 1901.0
## - EM_DOCTOR                     3  1721.0 1901.0
## - NS_NURSESATTITUDE              3  1721.2 1901.2
## - INR_ROOMPEACE                  3  1721.4 1901.4
## - FNB_FOODDELIVERYTIME           3  1721.4 1901.4
## <none>                         1715.6 1901.6
## - FNB_DIETICIAN                 3  1722.2 1902.2
## - InsPayorcategory               4  1724.7 1902.7
## - AgeYrs                        1  1719.1 1903.1
## - FNB_STAFFATTITUDE              3  1725.4 1905.4
## - EM_OVERALL                     3  1726.0 1906.0
## - DP_DISCHARGEQUERIES             3  1728.2 1908.2
## - DOC_VISITS                      3  1730.8 1910.8
## - CE_ACCESSIBILITY                 3  1749.8 1929.8
## - CE_CSAT                         3  1781.1 1961.1
## - CE_VALUEFORMONEY                 3  1800.9 1980.9
##
## Step: AIC=1897.62
## NPS_Status ~ AgeYrs + Sex + Department + Estimatedcost + InsPayorcategory +
##             CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##             EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARIFFPACKAGESEXPLAINATION +
##             INR_ROOMCLEANLINESS + INR_ROOMPEACE + INR_ROOMEQUIPMENT +
##             FNB_FOODQUALITY + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##             FNB_STAFFATTITUDE + AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD +
##             DOC_VISITS + NS_NURSESATTITUDE + NS_NURSEPATIENCE + OVS_SECURITYATTITUDE +
##             DP_DISCHARGETIME + DP_DISCHARGEQUERIES + DP_DISCHARGEPROCESS +
##             LengthofStay
##
##                                         Df Deviance    AIC
## - NS_NURSEPATIENCE            3  1719.6 1893.6
## - Department                  6  1725.8 1893.8
## - DP_DISCHARGEPROCESS         3  1720.3 1894.3
## - FNB_FOODQUALITY            3  1720.3 1894.3
## - AD_TIME                     3  1720.4 1894.4
## - EM_IMMEDIATEATTENTION      3  1721.0 1895.0
## - AE_PATIENTSTATUSINFO        3  1721.3 1895.3
## - OVS_SECURITYATTITUDE         3  1721.4 1895.4
## - INR_ROOMEQUIPMENT           3  1721.5 1895.5

```

```

## - LengthofStay           1  1717.7 1895.7
## - Sex                   1  1718.0 1896.0
## - INR_ROOMCLEANLINESS  3  1722.1 1896.1
## - EM_NURSING            3  1722.2 1896.2
## - Estimatedcost          1  1718.3 1896.3
## - AD_TARRIFFPACKAGESEXPLAINATION 3  1722.5 1896.5
## - AE_ATTENDEEFOOD        3  1722.6 1896.6
## - DP_DISCHARGETIME       3  1722.7 1896.7
## - NS_NURSESATTITUDE      3  1723.0 1897.0
## - EM_DOCTOR              3  1723.0 1897.0
## - FNB_FOODDELIVERYTIME   3  1723.1 1897.1
## - INR_ROOMPEACE           3  1723.1 1897.1
## <none>                  1717.6 1897.6
## - FNB_DIETICIAN          3  1724.0 1898.0
## - InsPayorcategory        4  1726.6 1898.6
## - AgeYrs                 1  1721.0 1899.0
## - FNB_STAFFATTITUDE       3  1727.7 1901.7
## - EM_OVERALL              3  1727.9 1901.9
## - DP_DISCHARGEQUERIES     3  1731.2 1905.2
## - DOC_VISITS              3  1733.3 1907.3
## - CE_ACCESSIBILITY         3  1752.2 1926.2
## - CE_CSAT                  3  1784.0 1958.0
## - CE_VALUEFORMONEY         3  1806.8 1980.8
##
## Step: AIC=1893.63
## NPS_Status ~ AgeYrs + Sex + Department + Estimatedcost + InsPayorcategory +
##             CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##             EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARRIFFPACKAGESEXPLAINATION +
##             INR_ROOMCLEANLINESS + INR_ROOMPEACE + INR_ROOMEQUIPMENT +
##             FNB_FOODQUALITY + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##             FNB_STAFFATTITUDE + AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD +
##             DOC_VISITS + NS_NURSESATTITUDE + OVS_SECURITYATTITUDE + DP_DISCHARGETIME +
##             DP_DISCHARGEQUERIES + DP_DISCHARGEPROCESS + LengthofStay
##
##                                     Df Deviance    AIC
## - Department                  6  1727.6 1889.6
## - FNB_FOODQUALITY             3  1722.2 1890.2
## - DP_DISCHARGEPROCESS          3  1722.3 1890.3
## - AD_TIME                      3  1722.6 1890.6
## - EM_IMMEDIATEATTENTION        3  1723.2 1891.2
## - AE_PATIENTSTATUSINFO         3  1723.5 1891.5
## - INR_ROOMEQUIPMENT            3  1723.7 1891.7
## - LengthofStay                 1  1719.7 1891.7
## - Sex                          1  1720.0 1892.0
## - EM_NURSING                   3  1724.2 1892.2
## - INR_ROOMCLEANLINESS          3  1724.3 1892.3
## - OVS_SECURITYATTITUDE          3  1724.4 1892.4
## - Estimatedcost                 1  1720.4 1892.4
## - AE_ATTENDEEFOOD               3  1724.4 1892.4
## - DP_DISCHARGETIME              3  1724.6 1892.6
## - AD_TARRIFFPACKAGESEXPLAINATION 3  1724.6 1892.6
## - FNB_FOODDELIVERYTIME          3  1724.7 1892.7
## - EM_DOCTOR                      3  1725.1 1893.1
## <none>                         1719.6 1893.6

```

```

## - INR_ROOMPEACE            3  1725.8 1893.8
## - FNB_DIETICIAN           3  1726.2 1894.2
## - InsPayorcategory        4  1728.3 1894.3
## - AgeYrs                  1  1723.0 1895.0
## - NS_NURSESATTITUDE       3  1727.3 1895.3
## - FNB_STAFFATTITUDE       3  1728.6 1896.6
## - EM_OVERALL               3  1730.3 1898.3
## - DP_DISCHARGEQUERIES     3  1733.0 1901.0
## - DOC_VISITS               3  1734.7 1902.7
## - CE_ACCESSIBILITY         3  1753.2 1921.2
## - CE_CSAT                  3  1787.5 1955.5
## - CE_VALUEFORMONEY         3  1808.8 1976.8
##
## Step: AIC=1889.59
## NPS_Status ~ AgeYrs + Sex + Estimatedcost + InsPayorcategory +
##             CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##             EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARIFFPACKAGESEXPLAINATION +
##             INR_ROOMCLEANLINESS + INR_ROOMPEACE + INR_ROOMEQUIPMENT +
##             FNB_FOODQUALITY + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##             FNB_STAFFATTITUDE + AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD +
##             DOC_VISITS + NS_NURSESATTITUDE + OVS_SECURITYATTITUDE + DP_DISCHARGETIME +
##             DP_DISCHARGEQUERIES + DP_DISCHARGEPROCESS + LengthofStay
##
##                                         Df Deviance    AIC
## - FNB_FOODQUALITY            3  1730.1 1886.1
## - DP_DISCHARGEPROCESS        3  1730.2 1886.2
## - AD_TIME                   3  1730.8 1886.8
## - EM_IMMEDIATEATTENTION     3  1731.2 1887.2
## - LengthofStay              1  1727.6 1887.6
## - AE_PATIENTSTATUSINFO      3  1731.7 1887.7
## - INR_ROOMEQUIPMENT         3  1731.9 1887.9
## - Sex                        1  1728.1 1888.1
## - EM_NURSING                 3  1732.2 1888.2
## - AE_ATTENDEEFOOD            3  1732.3 1888.3
## - AD_TARIFFPACKAGESEXPLAINATION 3  1732.4 1888.4
## - OVS_SECURITYATTITUDE       3  1732.5 1888.5
## - DP_DISCHARGETIME           3  1732.5 1888.5
## - INR_ROOMCLEANLINESS        3  1732.7 1888.7
## - FNB_FOODDELIVERYTIME       3  1732.7 1888.7
## - AgeYrs                     1  1729.4 1889.4
## - EM_DOCTOR                  3  1733.5 1889.5
## <none>                      1727.6 1889.6
## - INR_ROOMPEACE              3  1733.8 1889.8
## - Estimatedcost              1  1729.8 1889.8
## - FNB_DIETICIAN              3  1734.2 1890.2
## - NS_NURSESATTITUDE          3  1735.7 1891.7
## - InsPayorcategory           4  1738.0 1892.0
## - FNB_STAFFATTITUDE          3  1736.7 1892.7
## - EM_OVERALL                 3  1738.2 1894.2
## - DP_DISCHARGEQUERIES         3  1741.9 1897.9
## - DOC_VISITS                 3  1743.1 1899.1
## - CE_ACCESSIBILITY            3  1760.2 1916.2
## - CE_CSAT                     3  1794.5 1950.5
## - CE_VALUEFORMONEY            3  1817.0 1973.0

```

```

## Step: AIC=1886.13
## NPS_Status ~ AgeYrs + Sex + Estimatedcost + InsPayorcategory +
##   CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##   EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARIFFPACKAGESEXPLANATION +
##   INR_ROOMCLEANLINESS + INR_ROOMPEACE + INR_ROOMEQUIPMENT +
##   FNB_FOODDELIVERYTIME + FNB_DIETICIAN + FNB_STAFFATTITUDE +
##   AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD + DOC_VISITS + NS_NURSESATTITUDE +
##   OVS_SECURITYATTITUDE + DP_DISCHARGETIME + DP_DISCHARGEQUERIES +
##   DP_DISCHARGEPROCESS + LengthofStay
##
##                                     Df Deviance    AIC
## - DP_DISCHARGEPROCESS            3  1732.7 1882.7
## - AD_TIME                         3  1733.2 1883.2
## - EM_IMMEDIATEATTENTION          3  1733.7 1883.7
## - AE_PATIENTSTATUSINFO           3  1734.0 1884.0
## - LengthofStay                   1  1730.2 1884.2
## - INR_ROOMEQUIPMENT              3  1734.5 1884.5
## - Sex                            1  1730.6 1884.6
## - AD_TARIFFPACKAGESEXPLANATION   3  1734.8 1884.8
## - EM_NURSING                      3  1735.0 1885.0
## - AE_ATTENDEEFOOD                 3  1735.0 1885.0
## - OVS_SECURITYATTITUDE            3  1735.1 1885.1
## - DP_DISCHARGETIME                 3  1735.5 1885.5
## - AgeYrs                          1  1731.7 1885.7
## - INR_ROOMCLEANLINESS             3  1735.9 1885.9
## - INR_ROOMPEACE                   3  1736.1 1886.1
## <none>                           1730.1 1886.1
## - EM_DOCTOR                        3  1736.3 1886.3
## - Estimatedcost                   1  1732.3 1886.3
## - FNB_DIETICIAN                  3  1736.4 1886.4
## - FNB_FOODDELIVERYTIME            3  1736.8 1886.8
## - InsPayorcategory                4  1740.3 1888.3
## - NS_NURSESATTITUDE               3  1738.6 1888.6
## - FNB_STAFFATTITUDE               3  1739.1 1889.1
## - EM_OVERALL                       3  1740.5 1890.5
## - DP_DISCHARGEQUERIES              3  1743.8 1893.8
## - DOC_VISITS                      3  1745.7 1895.7
## - CE_ACCESSIBILITY                 3  1762.0 1912.0
## - CE_CSAT                          3  1797.4 1947.4
## - CE_VALUEFORMONEY                 3  1820.7 1970.7
##
## Step: AIC=1882.72
## NPS_Status ~ AgeYrs + Sex + Estimatedcost + InsPayorcategory +
##   CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##   EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TIME + AD_TARIFFPACKAGESEXPLANATION +
##   INR_ROOMCLEANLINESS + INR_ROOMPEACE + INR_ROOMEQUIPMENT +
##   FNB_FOODDELIVERYTIME + FNB_DIETICIAN + FNB_STAFFATTITUDE +
##   AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD + DOC_VISITS + NS_NURSESATTITUDE +
##   OVS_SECURITYATTITUDE + DP_DISCHARGETIME + DP_DISCHARGEQUERIES +
##   LengthofStay
##
##                                     Df Deviance    AIC
## - AD_TIME                         3  1735.6 1879.6

```

```

## - AE_PATIENTSTATUSINFO            3  1736.5 1880.5
## - EM_IMMEDIATEATTENTION         3  1736.7 1880.7
## - LengthofStay                   1  1732.7 1880.7
## - Sex                            1  1733.1 1881.1
## - AE_ATTENDEEFOOD                3  1737.3 1881.3
## - INR_ROOMEQUIPMENT              3  1737.3 1881.3
## - AD_TARRIFFPACKAGESEXPLAINATION 3  1737.3 1881.3
## - DP_DISCHARGETIME               3  1737.3 1881.3
## - OVS_SECURITYATTITUDE           3  1737.8 1881.8
## - EM_NURSING                      3  1738.0 1882.0
## - AgeYrs                          1  1734.3 1882.3
## - INR_ROOMPEACE                   3  1738.5 1882.5
## - INR_ROOMCLEANLINESS             3  1738.6 1882.6
## - EM_DOCTOR                        3  1738.7 1882.7
## <none>                           1732.7 1882.7
## - Estimatedcost                  1  1734.9 1882.9
## - FNB_DIETICIAN                  3  1739.4 1883.4
## - FNB_FOODDELIVERYTIME            3  1739.5 1883.5
## - NS_NURSESATTITUDE               3  1740.8 1884.8
## - InsPayorcategory                4  1742.8 1884.8
## - FNB_STAFFATTITUDE               3  1742.7 1886.7
## - EM_OVERALL                       3  1743.2 1887.2
## - DP_DISCHARGEQUERIES              3  1745.5 1889.5
## - DOC_VISITS                      3  1747.9 1891.9
## - CE_ACCESSIBILITY                 3  1764.9 1908.9
## - CE_CSAT                          3  1799.6 1943.6
## - CE_VALUEFORMONEY                 3  1822.9 1966.9
##
## Step: AIC=1879.57
## NPS_Status ~ AgeYrs + Sex + Estimatedcost + InsPayorcategory +
##             CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##             EM_NURSING + EM_DOCTOR + EM_OVERALL + AD_TARRIFFPACKAGESEXPLAINATION +
##             INR_ROOMCLEANLINESS + INR_ROOMPEACE + INR_ROOMEQUIPMENT +
##             FNB_FOODDELIVERYTIME + FNB_DIETICIAN + FNB_STAFFATTITUDE +
##             AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD + DOC_VISITS + NS_NURSESATTITUDE +
##             OVS_SECURITYATTITUDE + DP_DISCHARGETIME + DP_DISCHARGEQUERIES +
##             LengthofStay
##
##                                     Df Deviance    AIC
## - AD_TARRIFFPACKAGESEXPLAINATION 3  1739.1 1877.1
## - EM_IMMEDIATEATTENTION          3  1739.1 1877.1
## - LengthofStay                   1  1735.6 1877.6
## - AE_PATIENTSTATUSINFO           3  1739.7 1877.7
## - Sex                            1  1736.1 1878.1
## - DP_DISCHARGETIME                3  1740.2 1878.2
## - AE_ATTENDEEFOOD                 3  1740.2 1878.2
## - INR_ROOMEQUIPMENT               3  1740.7 1878.7
## - EM_NURSING                      3  1741.0 1879.0
## - OVS_SECURITYATTITUDE             3  1741.0 1879.0
## - INR_ROOMPEACE                   3  1741.0 1879.0
## - INR_ROOMCLEANLINESS              3  1741.3 1879.3
## - AgeYrs                          1  1737.5 1879.5
## <none>                           1735.6 1879.6
## - EM_DOCTOR                        3  1741.6 1879.6

```

```

## - Estimatedcost          1  1737.7 1879.7
## - FNB_DIETICIAN         3  1742.0 1880.0
## - FNB_FOODDELIVERYTIME  3  1742.4 1880.4
## - InsPayorcategory      4  1745.4 1881.4
## - NS_NURSESATTITUDE     3  1743.8 1881.8
## - EM_OVERALL             3  1746.0 1884.0
## - FNB_STAFFATTITUDE      3  1746.4 1884.4
## - DP_DISCHARGEQUERIES    3  1748.0 1886.0
## - DOC_VISITS              3  1751.7 1889.7
## - CE_ACCESSIBILITY        3  1767.9 1905.9
## - CE_CSAT                  3  1801.7 1939.7
## - CE_VALUEFORMONEY        3  1827.5 1965.5
##
## Step: AIC=1877.06
## NPS_Status ~ AgeYrs + Sex + Estimatedcost + InsPayorcategory +
##             CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_IMMEDIATEATTENTION +
##             EM_NURSING + EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS +
##             INR_ROOMPEACE + INR_ROOMEQUIPMENT + FNB_FOODDELIVERYTIME +
##             FNB_DIETICIAN + FNB_STAFFATTITUDE + AE_PATIENTSTATUSINFO +
##             AE_ATTENDEEFOOD + DOC_VISITS + NS_NURSESATTITUDE + OVS_SECURITYATTITUDE +
##             DP_DISCHARGETIME + DP_DISCHARGEQUERIES + LengthofStay
##
##                               Df Deviance   AIC
## - EM_IMMEDIATEATTENTION 3  1742.8 1874.8
## - LengthofStay            1  1739.1 1875.1
## - AE_ATTENDEEFOOD         3  1743.2 1875.2
## - AE_PATIENTSTATUSINFO   3  1743.2 1875.2
## - Sex                      1  1739.5 1875.5
## - DP_DISCHARGETIME        3  1744.0 1876.0
## - OVS_SECURITYATTITUDE    3  1744.1 1876.1
## - INR_ROOMEQUIPMENT       3  1744.3 1876.3
## - INR_ROOMPEACE            3  1744.4 1876.4
## - INR_ROOMCLEANLINESS     3  1744.8 1876.8
## - AgeYrs                  1  1741.0 1877.0
## <none>                   1739.1 1877.1
## - EM_NURSING               3  1745.2 1877.2
## - Estimatedcost             1  1741.2 1877.2
## - EM_DOCTOR                 3  1745.6 1877.6
## - FNB_DIETICIAN             3  1745.8 1877.8
## - FNB_FOODDELIVERYTIME      3  1746.4 1878.4
## - InsPayorcategory          4  1748.6 1878.6
## - NS_NURSESATTITUDE          3  1747.8 1879.8
## - EM_OVERALL                 3  1748.9 1880.9
## - FNB_STAFFATTITUDE          3  1749.4 1881.4
## - DP_DISCHARGEQUERIES        3  1752.3 1884.3
## - DOC_VISITS                  3  1756.1 1888.1
## - CE_ACCESSIBILITY            3  1771.2 1903.2
## - CE_CSAT                      3  1804.3 1936.3
## - CE_VALUEFORMONEY            3  1831.0 1963.0
##
## Step: AIC=1874.82
## NPS_Status ~ AgeYrs + Sex + Estimatedcost + InsPayorcategory +
##             CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_NURSING +
##             EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS + INR_ROOMPEACE +

```

```

##  INR_ROOMEQUIPMENT + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##  FNB_STAFFATTITUDE + AE_PATIENTSTATUSINFO + AE_ATTENDEEFOOD +
##  DOC_VISITS + NS_NURSESATTITUDE + OVS_SECURITYATTITUDE + DP_DISCHARGETIME +
##  DP_DISCHARGEQUERIES + LengthofStay
##
##              Df Deviance    AIC
## - AE_ATTENDEEFOOD      3  1746.8 1872.8
## - LengthofStay          1  1742.8 1872.8
## - AE_PATIENTSTATUSINFO 3  1747.0 1873.0
## - Sex                  1  1743.3 1873.3
## - EM_NURSING            3  1747.5 1873.5
## - DP_DISCHARGETIME      3  1747.6 1873.6
## - INR_ROOMEQUIPMENT     3  1747.9 1873.9
## - OVS_SECURITYATTITUDE   3  1748.1 1874.1
## - INR_ROOMPEACE          3  1748.2 1874.2
## - AgeYrs                1  1744.4 1874.4
## <none>                  1742.8 1874.8
## - INR_ROOMCLEANLINESS    3  1748.8 1874.8
## - Estimatedcost          1  1745.0 1875.0
## - FNB_DIETICIAN          3  1749.0 1875.0
## - EM_DOCTOR               3  1749.6 1875.6
## - FNB_FOODDELIVERYTIME    3  1749.7 1875.7
## - InsPayorcategory        4  1752.0 1876.0
## - NS_NURSESATTITUDE       3  1751.4 1877.4
## - EM_OVERALL               3  1751.6 1877.6
## - FNB_STAFFATTITUDE        3  1752.6 1878.6
## - DP_DISCHARGEQUERIES      3  1756.5 1882.5
## - DOC_VISITS                 3  1761.3 1887.3
## - CE_ACCESSIBILITY         3  1774.5 1900.5
## - CE_CSAT                   3  1806.7 1932.7
## - CE_VALUEFORMONEY         3  1834.6 1960.6
##
## Step: AIC=1872.83
## NPS_Status ~ AgeYrs + Sex + Estimatedcost + InsPayorcategory +
##             CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_NURSING +
##             EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS + INR_ROOMPEACE +
##             INR_ROOMEQUIPMENT + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##             FNB_STAFFATTITUDE + AE_PATIENTSTATUSINFO + DOC_VISITS + NS_NURSESATTITUDE +
##             OVS_SECURITYATTITUDE + DP_DISCHARGETIME + DP_DISCHARGEQUERIES +
##             LengthofStay
##
##              Df Deviance    AIC
## - AE_PATIENTSTATUSINFO  3  1750.8 1870.8
## - LengthofStay           1  1746.9 1870.9
## - EM_NURSING              3  1751.4 1871.4
## - Sex                     1  1747.4 1871.4
## - INR_ROOMEQUIPMENT        3  1751.7 1871.7
## - INR_ROOMPEACE             3  1752.0 1872.0
## - OVS_SECURITYATTITUDE      3  1752.2 1872.2
## - INR_ROOMCLEANLINESS       3  1752.3 1872.3
## - AgeYrs                   1  1748.4 1872.4
## - Estimatedcost             1  1748.8 1872.8
## <none>                      1746.8 1872.8
## - DP_DISCHARGETIME          3  1753.0 1873.0

```

```

## - EM_DOCTOR            3  1753.7 1873.7
## - InsPayorcategory     4  1756.1 1874.1
## - FNB_FOODDELIVERYTIME 3  1754.2 1874.2
## - EM_OVERALL            3  1755.1 1875.1
## - FNB_DIETICIAN          3  1755.3 1875.3
## - NS_NURSESATTITUDE      3  1755.3 1875.3
## - FNB_STAFFATTITUDE       3  1756.4 1876.4
## - DP_DISCHARGEQUERIES     3  1760.1 1880.1
## - DOC_VISITS              3  1764.3 1884.3
## - CE_ACCESSIBILITY         3  1779.0 1899.0
## - CE_CSAT                  3  1811.4 1931.4
## - CE_VALUEFORMONEY         3  1839.0 1959.0
##
## Step: AIC=1870.75
## NPS_Status ~ AgeYrs + Sex + Estimatedcost + InsPayorcategory +
##             CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_NURSING +
##             EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS + INR_ROOMPEACE +
##             INR_ROOMEQUIPMENT + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##             FNB_STAFFATTITUDE + DOC_VISITS + NS_NURSESATTITUDE + OVS_SECURITYATTITUDE +
##             DP_DISCHARGETIME + DP_DISCHARGEQUERIES + LengthofStay
##
##                                     Df Deviance    AIC
## - LengthofStay                1  1750.8 1868.8
## - Sex                          1  1751.4 1869.4
## - EM_NURSING                   3  1755.7 1869.7
## - OVS_SECURITYATTITUDE        3  1755.8 1869.8
## - INR_ROOMEQUIPMENT            3  1756.2 1870.2
## - INR_ROOMPEACE                 3  1756.4 1870.4
## - INR_ROOMCLEANLINESS          3  1756.4 1870.4
## - AgeYrs                       1  1752.5 1870.5
## - Estimatedcost                 1  1752.5 1870.5
## - DP_DISCHARGETIME              3  1756.6 1870.6
## <none>                         1750.8 1870.8
## - InsPayorcategory              4  1759.7 1871.7
## - FNB_FOODDELIVERYTIME          3  1757.8 1871.8
## - EM_DOCTOR                      3  1758.0 1872.0
## - FNB_DIETICIAN                  3  1758.1 1872.1
## - EM_OVERALL                     3  1759.2 1873.2
## - NS_NURSESATTITUDE               3  1759.7 1873.7
## - FNB_STAFFATTITUDE                3  1761.1 1875.1
## - DP_DISCHARGEQUERIES              3  1763.9 1877.9
## - DOC_VISITS                      3  1772.0 1886.0
## - CE_ACCESSIBILITY                  3  1783.2 1897.2
## - CE_CSAT                          3  1816.4 1930.4
## - CE_VALUEFORMONEY                  3  1844.5 1958.5
##
## Step: AIC=1868.77
## NPS_Status ~ AgeYrs + Sex + Estimatedcost + InsPayorcategory +
##             CE_ACCESSIBILITY + CE_CSAT + CE_VALUEFORMONEY + EM_NURSING +
##             EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS + INR_ROOMPEACE +
##             INR_ROOMEQUIPMENT + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##             FNB_STAFFATTITUDE + DOC_VISITS + NS_NURSESATTITUDE + OVS_SECURITYATTITUDE +
##             DP_DISCHARGETIME + DP_DISCHARGEQUERIES
##

```

```

##                                     Df Deviance    AIC
## - Sex                           1  1751.5 1867.5
## - EM_NURSING                     3  1755.7 1867.7
## - OVS_SECURITYATTITUDE          3  1755.8 1867.8
## - INR_ROOMEQUIPMENT              3  1756.2 1868.2
## - INR_ROOMPEACE                  3  1756.4 1868.4
## - INR_ROOMCLEANLINESS            3  1756.4 1868.4
## - AgeYrs                         1  1752.5 1868.5
## - Estimatedcost                  1  1752.6 1868.6
## - DP_DISCHARGETIME                3  1756.6 1868.6
## <none>                          1750.8 1868.8
## - InsPayorcategory               4  1759.7 1869.7
## - FNB_FOODDELIVERYTIME           3  1757.8 1869.8
## - EM_DOCTOR                       3  1758.0 1870.0
## - FNB_DIETICIAN                  3  1758.1 1870.1
## - EM_OVERALL                      3  1759.2 1871.2
## - NS_NURSESATTITUDE               3  1759.7 1871.7
## - FNB_STAFFATTITUDE                3  1761.2 1873.2
## - DP_DISCHARGEQUERIES             3  1763.9 1875.9
## - DOC_VISITS                      3  1772.0 1884.0
## - CE_ACCESSIBILITY                 3  1783.3 1895.3
## - CE_CSAT                          3  1816.4 1928.4
## - CE_VALUEFORMONEY                 3  1844.8 1956.8
##
## Step: AIC=1867.46
## NPS_Status ~ AgeYrs + Estimatedcost + InsPayorcategory + CE_ACCESSIBILITY +
##             CE_CSAT + CE_VALUEFORMONEY + EM_NURSING + EM_DOCTOR + EM_OVERALL +
##             INR_ROOMCLEANLINESS + INR_ROOMPEACE + INR_ROOMEQUIPMENT +
##             FNB_FOODDELIVERYTIME + FNB_DIETICIAN + FNB_STAFFATTITUDE +
##             DOC_VISITS + NS_NURSESATTITUDE + OVS_SECURITYATTITUDE + DP_DISCHARGETIME +
##             DP_DISCHARGEQUERIES
##
##                                     Df Deviance    AIC
## - EM_NURSING                     3  1756.4 1866.4
## - OVS_SECURITYATTITUDE            3  1756.4 1866.4
## - INR_ROOMEQUIPMENT               3  1756.9 1866.9
## - INR_ROOMPEACE                   3  1757.0 1867.0
## - INR_ROOMCLEANLINESS             3  1757.1 1867.1
## - AgeYrs                          1  1753.3 1867.3
## - Estimatedcost                   1  1753.3 1867.3
## - DP_DISCHARGETIME                 3  1757.3 1867.3
## <none>                           1751.5 1867.5
## - FNB_FOODDELIVERYTIME            3  1758.3 1868.3
## - InsPayorcategory                4  1760.7 1868.7
## - FNB_DIETICIAN                  3  1758.8 1868.8
## - EM_DOCTOR                        3  1758.8 1868.8
## - EM_OVERALL                      3  1759.8 1869.8
## - NS_NURSESATTITUDE                3  1760.4 1870.4
## - FNB_STAFFATTITUDE                 3  1761.7 1871.7
## - DP_DISCHARGEQUERIES              3  1764.5 1874.5
## - DOC_VISITS                      3  1772.8 1882.8
## - CE_ACCESSIBILITY                 3  1783.9 1893.9
## - CE_CSAT                          3  1817.3 1927.3
## - CE_VALUEFORMONEY                 3  1845.1 1955.1

```

```

## Step: AIC=1866.4
## NPS_Status ~ AgeYrs + Estimatedcost + InsPayorcategory + CE_ACCESSIBILITY +
##   CE_CSAT + CE_VALUEFORMONEY + EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS +
##   INR_ROOMPEACE + INR_ROOMEQUIPMENT + FNB_FOODDELIVERYTIME +
##   FNB_DIETICIAN + FNB_STAFFATTITUDE + DOC_VISITS + NS_NURSESATTITUDE +
##   OVS_SECURITYATTITUDE + DP_DISCHARGETIME + DP_DISCHARGEQUERIES
##
##                                     Df Deviance    AIC
## - OVS_SECURITYATTITUDE      3  1761.8 1865.8
## - INR_ROOMPEACE              3  1761.9 1865.9
## - DP_DISCHARGETIME           3  1762.0 1866.0
## - INR_ROOMEQUIPMENT          3  1762.0 1866.0
## - Estimatedcost              1  1758.1 1866.1
## <none>                      1  1756.4 1866.4
## - AgeYrs                     1  1758.4 1866.4
## - INR_ROOMCLEANLINESS        3  1762.8 1866.8
## - FNB_FOODDELIVERYTIME       3  1762.9 1866.9
## - FNB_DIETICIAN              3  1763.4 1867.4
## - InsPayorcategory            4  1765.8 1867.8
## - NS_NURSESATTITUDE           3  1764.2 1868.2
## - EM_OVERALL                  3  1765.5 1869.5
## - FNB_STAFFATTITUDE           3  1767.6 1871.6
## - EM_DOCTOR                   3  1767.6 1871.6
## - DP_DISCHARGEQUERIES         3  1769.4 1873.4
## - DOC_VISITS                  3  1776.6 1880.6
## - CE_ACCESSIBILITY             3  1790.9 1894.9
## - CE_CSAT                      3  1820.8 1924.8
## - CE_VALUEFORMONEY              3  1851.9 1955.9
##
## Step: AIC=1865.75
## NPS_Status ~ AgeYrs + Estimatedcost + InsPayorcategory + CE_ACCESSIBILITY +
##   CE_CSAT + CE_VALUEFORMONEY + EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS +
##   INR_ROOMPEACE + INR_ROOMEQUIPMENT + FNB_FOODDELIVERYTIME +
##   FNB_DIETICIAN + FNB_STAFFATTITUDE + DOC_VISITS + NS_NURSESATTITUDE +
##   DP_DISCHARGETIME + DP_DISCHARGEQUERIES
##
##                                     Df Deviance    AIC
## - INR_ROOMPEACE                3  1767.1 1865.1
## - INR_ROOMCLEANLINESS           3  1767.4 1865.4
## - AgeYrs                       1  1763.5 1865.5
## - DP_DISCHARGETIME               3  1767.6 1865.6
## - INR_ROOMEQUIPMENT              3  1767.7 1865.7
## <none>                         1761.8 1865.8
## - Estimatedcost                 1  1763.8 1865.8
## - FNB_FOODDELIVERYTIME          3  1768.2 1866.2
## - FNB_DIETICIAN                  3  1768.5 1866.5
## - InsPayorcategory                4  1771.0 1867.0
## - EM_OVERALL                     3  1770.5 1868.5
## - FNB_STAFFATTITUDE                3  1772.4 1870.4
## - EM_DOCTOR                       3  1773.0 1871.0
## - DP_DISCHARGEQUERIES              3  1773.6 1871.6
## - NS_NURSESATTITUDE                 3  1778.8 1876.8
## - DOC_VISITS                      3  1779.8 1877.8

```

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## - CE_ACCESSIBILITY      3   1796.6 1894.6
## - CE_CSAT                 3   1826.1 1924.1
## - CE_VALUEFORMONEY       3   1860.5 1958.5
##
## Step: AIC=1865.08
## NPS_Status ~ AgeYrs + Estimatedcost + InsPayorcategory + CE_ACCESSIBILITY +
##             CE_CSAT + CE_VALUEFORMONEY + EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS +
##             INR_ROOMEQUIPMENT + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##             FNB_STAFFATTITUDE + DOC_VISITS + NS_NURSESATTITUDE + DP_DISCHARGETIME +
##             DP_DISCHARGEQUERIES
##
##                                     Df Deviance     AIC
## - DP_DISCHARGETIME          3   1772.7 1864.7
## - AgeYrs                     1   1768.8 1864.8
## - Estimatedcost              1   1768.9 1864.9
## <none>                      1767.1 1865.1
## - INR_ROOMEQUIPMENT          3   1773.2 1865.2
## - INR_ROOMCLEANLINESS        3   1773.3 1865.3
## - FNB_DIETICIAN              3   1773.5 1865.5
## - FNB_FOODDELIVERYTIME       3   1773.9 1865.9
## - InsPayorcategory            4   1776.5 1866.5
## - EM_OVERALL                  3   1775.6 1867.6
## - FNB_STAFFATTITUDE           3   1776.6 1868.6
## - EM_DOCTOR                   3   1778.4 1870.4
## - DP_DISCHARGEQUERIES         3   1779.2 1871.2
## - NS_NURSESATTITUDE           3   1785.2 1877.2
## - DOC_VISITS                  3   1785.6 1877.6
## - CE_ACCESSIBILITY             3   1801.8 1893.8
## - CE_CSAT                      3   1830.5 1922.5
## - CE_VALUEFORMONEY             3   1866.7 1958.7
##
## Step: AIC=1864.7
## NPS_Status ~ AgeYrs + Estimatedcost + InsPayorcategory + CE_ACCESSIBILITY +
##             CE_CSAT + CE_VALUEFORMONEY + EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS +
##             INR_ROOMEQUIPMENT + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##             FNB_STAFFATTITUDE + DOC_VISITS + NS_NURSESATTITUDE + DP_DISCHARGEQUERIES
##
##                                     Df Deviance     AIC
## - Estimatedcost               1   1774.0 1864.0
## - INR_ROOMEQUIPMENT            3   1778.3 1864.3
## - AgeYrs                      1   1774.5 1864.5
## <none>                        1772.7 1864.7
## - InsPayorcategory              4   1781.1 1865.1
## - INR_ROOMCLEANLINESS          3   1779.3 1865.3
## - FNB_DIETICIAN                3   1779.3 1865.3
## - FNB_FOODDELIVERYTIME         3   1780.0 1866.0
## - EM_OVERALL                   3   1781.0 1867.0
## - FNB_STAFFATTITUDE             3   1781.8 1867.8
## - EM_DOCTOR                     3   1783.8 1869.8
## - NS_NURSESATTITUDE              3   1792.4 1878.4
## - DOC_VISITS                    3   1792.9 1878.9
## - DP_DISCHARGEQUERIES            3   1802.0 1888.0
## - CE_ACCESSIBILITY                3   1806.6 1892.6
## - CE_CSAT                         3   1837.9 1923.9

```

```

## - CE_VALUEFORMONEY      3  1875.5 1961.5
##
## Step: AIC=1864.02
## NPS_Status ~ AgeYrs + InsPayorcategory + CE_ACCESSIBILITY + CE_CSAT +
##              CE_VALUEFORMONEY + EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS +
##              INR_ROOMEQUIPMENT + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##              FNB_STAFFATTITUDE + DOC_VISITS + NS_NURSESATTITUDE + DP_DISCHARGEQUERIES
##
##                                     Df Deviance    AIC
## - AgeYrs                      1  1775.3 1863.3
## - INR_ROOMEQUIPMENT            3  1779.6 1863.6
## <none>                         1774.0 1864.0
## - INR_ROOMCLEANLINESS          3  1780.5 1864.5
## - InsPayorcategory             4  1782.7 1864.7
## - FNB_DIETICIAN                3  1781.0 1865.0
## - FNB_FOODDELIVERYTIME         3  1781.1 1865.1
## - EM_OVERALL                    3  1782.2 1866.2
## - FNB_STAFFATTITUDE             3  1783.0 1867.0
## - EM_DOCTOR                      3  1785.0 1869.0
## - NS_NURSESATTITUDE              3  1794.2 1878.2
## - DOC_VISITS                     3  1794.9 1878.9
## - DP_DISCHARGEQUERIES            3  1803.4 1887.4
## - CE_ACCESSIBILITY               3  1807.6 1891.6
## - CE_CSAT                          3  1839.4 1923.4
## - CE_VALUEFORMONEY                3  1877.0 1961.0
##
## Step: AIC=1863.32
## NPS_Status ~ InsPayorcategory + CE_ACCESSIBILITY + CE_CSAT +
##              CE_VALUEFORMONEY + EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS +
##              INR_ROOMEQUIPMENT + FNB_FOODDELIVERYTIME + FNB_DIETICIAN +
##              FNB_STAFFATTITUDE + DOC_VISITS + NS_NURSESATTITUDE + DP_DISCHARGEQUERIES
##
##                                     Df Deviance    AIC
## - INR_ROOMEQUIPMENT             3  1780.5 1862.5
## <none>                         1775.3 1863.3
## - INR_ROOMCLEANLINESS           3  1782.1 1864.1
## - FNB_FOODDELIVERYTIME          3  1782.2 1864.2
## - InsPayorcategory               4  1784.4 1864.4
## - FNB_DIETICIAN                  3  1782.5 1864.5
## - EM_OVERALL                      3  1783.3 1865.3
## - FNB_STAFFATTITUDE                 3  1784.5 1866.5
## - EM_DOCTOR                        3  1785.9 1867.9
## - NS_NURSESATTITUDE                  3  1795.6 1877.6
## - DOC_VISITS                       3  1796.2 1878.2
## - DP_DISCHARGEQUERIES                 3  1804.4 1886.4
## - CE_ACCESSIBILITY                   3  1809.0 1891.0
## - CE_CSAT                            3  1840.8 1922.8
## - CE_VALUEFORMONEY                   3  1878.5 1960.5
##
## Step: AIC=1862.48
## NPS_Status ~ InsPayorcategory + CE_ACCESSIBILITY + CE_CSAT +
##              CE_VALUEFORMONEY + EM_DOCTOR + EM_OVERALL + INR_ROOMCLEANLINESS +
##              FNB_FOODDELIVERYTIME + FNB_DIETICIAN + FNB_STAFFATTITUDE +
##              DOC_VISITS + NS_NURSESATTITUDE + DP_DISCHARGEQUERIES

```

```

##                                     Df Deviance    AIC
## <none>                               1780.5 1862.5
## - INR_ROOMCLEANLINESS      3   1787.0 1863.0
## - InsPayorcategory        4   1789.5 1863.5
## - FNB_DIETICIAN          3   1787.7 1863.7
## - FNB_FOODDELIVERYTIME   3   1788.2 1864.2
## - EM_OVERALL              3   1788.8 1864.8
## - FNB_STAFFATTITUDE       3   1789.4 1865.4
## - EM_DOCTOR                3   1791.1 1867.1
## - NS_NURSESATTITUDE        3   1800.5 1876.5
## - DOC_VISITS               3   1801.4 1877.4
## - DP_DISCHARGEQUERIES     3   1808.0 1884.0
## - CE_ACCESSIBILITY         3   1815.1 1891.1
## - CE_CSAT                  3   1846.2 1922.2
## - CE_VALUEFORMONEY         3   1884.1 1960.1

Y_Predict = ifelse(predict(Model_GLM, newdata = Test, type = "response") < 0.5,
  0, 1)

mean(Y_Predict != Test$NPS_Status)^2

## [1] 0.006790981

Conf_Mat_LR = confusionMatrix(as.factor(Y_Predict), Test$NPS_Status)

Accuracy_LR = Conf_Mat_LR$overall[1]

Accuracy_LR

## Accuracy
## 0.9175926

```

We get Accuracy of 0.9175926 after using the step function on our multiclass data and removing the quasi-separable variables.

Part 7

```

Data_BD = Data_BD[, -c(1, 2)]
Data_MD = Data_MD[, -c(1, 2)]

```

Random Forest and Ada-boost on Binary Classification:

```

Index_BC = sample(2, nrow(Data_BD), replace = T, prob = c(0.8, 0.2))
Train_BC = as.data.frame(Data_BD[Index_BC == 1, -which(names(Data_BD) %in% "CE_NPS")])

```

```

Test_BC = as.data.frame(Data_BD[Index_BC == 2, ])

Model_RF_BC = randomForest(NPS_Status ~ . - State - Country, data = Train_BC,
                           mtry = 7, ntree = 1000, importance = T, proximity = T, tuneRF = T)

Model_RF_BC

## 
## Call:
##   randomForest(formula = NPS_Status ~ . - State - Country, data = Train_BC,      mtry = 7, ntree = 1000)
##   Type of random forest: classification
##   Number of trees: 1000
##   No. of variables tried at each split: 7
##
##       OOB estimate of  error rate: 23.36%
## Confusion matrix:
##             Detractor Promotor class.error
## Detractor      973       656    0.4027010
## Promotor        346      2315    0.1300263

Y_Predict_BC_RF = predict(Model_RF_BC, newdata = Test_BC, type = "response")

Conf_Mat_RF_BC = confusionMatrix(Test_BC$NPS_Status, Y_Predict_BC_RF)

Accuracy_RF_BC = Conf_Mat_RF_BC$overall[1]

Accuracy_RF_BC

## Accuracy
## 0.7610536

Model_Boost = adaboost(NPS_Status ~ ., data = Train_BC, 10)

Y_Predict_AB = predict(Model_Boost, newdata = Test_BC, type = "response")

Conf_Mat_AB_BC = confusionMatrix(Test_BC$NPS_Status, Y_Predict_AB$class)

Accuracy_AB_BC = Conf_Mat_AB_BC$overall[1]

Accuracy_AB_BC

## Accuracy
## 0.7215428

```

We get Accuracy of 0.7610536 accuracy with random forest and 0.7215428 with Adaboost on our binary data.

Random Forest and Ada-boost on Multi Classification:

```

Data_Multi[, 13:47] = lapply(Data_Multi[, 13:47], function(x) factor(x, levels = 1:4,
  ordered = T))

Data_Multi = Data_Multi %>% mutate_if(is.character, as.factor)

Data_Multi$CE_NPS = factor(Data_Multi$CE_NPS, levels = 0:10, ordered = T)

Data_Multi$CE_NPS = as.factor(Data_Multi$CE_NPS)

Data_Multi = Data_Multi[, -which(names(Data_Multi) %in% c("AdmissionDate", "DischargeDate"))]

Data_Multi = Data_Multi[, -c(1, 2)]

split(names(Data_Multi), sapply(Data_Multi, function(x) paste(class(x), collapse = " ")))

## $factor
## [1] "MaritalStatus"      "Sex"                  "BedCategory"
## [4] "Department"         "InsPayorcategory" "State"
## [7] "Country"            "STATEZONE"          "NPS_Status"
##
## $numeric
## [1] "AgeYrs"           "Estimatedcost"   "LengthofStay"
##
## $`ordered factor`
## [1] "CE_ACCESSIBILITY"      "CE_CSAT"
## [3] "CE_VALUEFORMONEY"     "EM_IMMEDIATEATTENTION"
## [5] "EM_NURSING"          "EM_DOCTOR"
## [7] "EM_OVERALL"           "AD_TIME"
## [9] "AD_TARRIFFPACKAGESEXPLAINATION" "AD_STAFFATTITUDE"
## [11] "INR_ROOMCLEANLINESS"    "INR_ROOMPEACE"
## [13] "INR_ROOMEQUIPMENT"     "INR_ROOMAMBIENCE"
## [15] "FNB_FOODQUALITY"       "FNB_FOODDELIVERYTIME"
## [17] "FNB_DIETICIAN"        "FNB_STAFFATTITUDE"
## [19] "AE_ATTENDEECARE"       "AE_PATIENTSTATUSINFO"
## [21] "AE_ATTENDEEFOOD"        "DOC_TREATMENTEXPLAINATION"
## [23] "DOC_ATTITUDE"          "DOC_VISITS"
## [25] "DOC_TREATMENTEFFECTIVENESS" "NS_CALLBELLRESPONSE"
## [27] "NS_NURSESATTITUDE"      "NS_NURSEPROACTIVENESS"
## [29] "NS_NURSEPATIENCE"       "OVS_OVERALLSTAFFATTITUDE"
## [31] "OVS_OVERALLSTAFFPROMPTNESS" "OVS_SECURITYATTITUDE"
## [33] "DP_DISCHARGETIME"       "DP_DISCHARGEQUERIES"
## [35] "DP_DISCHARGEPROCESS"     "CE_NPS"

Index_MC = sample(2, nrow(Data_Multi), replace = T, prob = c(0.8, 0.2))

Train_MC = as.data.frame(Data_Multi[Index_MC == 1, -which(names(Data_Multi) %in%
  c("CE_NPS", "State"))])

Test_MC = as.data.frame(Data_Multi[Index_MC == 2, ])

Model_RF_MC = randomForest(NPS_Status ~ ., data = Train_MC, mtry = sqrt(ncol(Train_MC)),
  ntree = 500, nodesize = 5, importance = T, proximity = T)

```

```
Model_RF_MC
```

```
##  
## Call:  
##   randomForest(formula = NPS_Status ~ ., data = Train_MC, mtry = sqrt(ncol(Train_MC)),      ntree = 500  
##               Type of random forest: classification  
##                   Number of trees: 500  
## No. of variables tried at each split: 7  
##  
##           OOB estimate of  error rate: 28.61%  
## Confusion matrix:  
##             Detractor Passive Promotor class.error  
## Detractor       186     147     113  0.5829596  
## Passive          64     473     627  0.5936426  
## Promotor         12     255    2380  0.1008689  
  
Y_Predict_RF_MC = predict(Model_RF_MC, newdata = Test_MC, type = "class")  
  
Conf_Mat_RF_MC = confusionMatrix(Test_MC$NPS_Status, Y_Predict_RF_MC)  
  
Accuracy_RF_MC = Conf_Mat_RF_MC$overall[1]  
  
Accuracy_RF_MC  
  
## Accuracy  
## 0.7344891  
  
Model_AB_MC = boosting(NPS_Status ~ ., data = Train_MC, boos = TRUE)  
  
Y_Predict_AB_MC = predict(Model_AB_MC, newdata = Test_MC, type = "class")  
  
Conf_Mat_AB_MC = confusionMatrix(Test_MC$NPS_Status, as.factor(Y_Predict_AB_MC[["class"]]))  
  
Accuracy_AB_MC = Conf_Mat_AB_MC$overall[1]  
  
Accuracy_AB_MC  
  
## Accuracy  
## 0.6952555
```

We get about 0.7344891 accuracy with random forest and 0.6952555 on our Multiclass data.

Part 8

Up Sampling, Down Sampling and SMOTE for Binary Data:

Random Forest and Ada-Boost and the sampled Data:

```
Train_UP_BC = upSample(x = Train_BC[, -ncol(Train_BC)], y = Train_BC$NPS_Status)

Train_Down_BC = downSample(x = Train_BC[, -ncol(Train_BC)], y = Train_BC$NPS_Status)

Test_UP_BC = upSample(x = Test_BC[, -ncol(Test_BC)], y = Test_BC$NPS_Status)

Test_Down_BC = downSample(x = Test_BC[, -ncol(Test_BC)], y = Test_BC$NPS_Status)

Train_SMOTE_BC = SMOTE(NPS_Status ~ ., data = Train_BC, k = 5)

Train_SMOTE_BC = na.omit(Train_SMOTE_BC)

Test_SMOTE_BC = SMOTE(NPS_Status ~ ., data = Test_BC)

Test_SMOTE_BC = na.omit(Test_SMOTE_BC)

Model_RF_Down_BC = randomForest(Class ~ . - State - Country, data = Train_Down_BC,
                                  mtry = 7, ntree = 500, importance = T, proximity = T, tuneRF = T)

Model_RF_Down_BC
```

```
##  
## Call:  
##   randomForest(formula = Class ~ . - State - Country, data = Train_Down_BC,      mtry = 7, ntree = 500  
##                   Type of random forest: classification  
##                           Number of trees: 500  
## No. of variables tried at each split: 7  
##  
##           OOB estimate of  error rate: 24.25%  
## Confusion matrix:  
##             Detractor Promotor class.error  
## Detractor       1196       433    0.2658072  
## Promotor        357      1272    0.2191529  
  
Y_Predict_Down_BC_RF = predict(Model_RF_Down_BC, newdata = Test_Down_BC, type = "response")  
  
Conf_Mat_RF_Down_BC = confusionMatrix(Test_Down_BC$Class, as.factor(Y_Predict_Down_BC_RF))  
  
Accuracy_RF_Down_BC = Conf_Mat_RF_Down_BC$overall[1]  
  
Accuracy_RF_Down_BC
```

```

## Accuracy
## 0.7335958

Model_Boost_Down_BC = adaboost(Class ~ ., data = Train_Down_BC, 10)

Y_Predict_AB_Down_BC = predict(Model_Boost_Down_BC, newdata = Test_Down_BC,
                                type = "response")

Conf_Mat_AB_Down_BC = confusionMatrix(Test_Down_BC$Class, Y_Predict_AB_Down_BC$class)

Accuracy_AB_Down_BC = Conf_Mat_AB_Down_BC$overall[1]

Accuracy_AB_Down_BC

## Accuracy
## 0.6889764

Model_RF_UP_BC = randomForest(Class ~ . - State - Country, data = Train_UP_BC,
                               mtry = 7, ntree = 500, importance = T, proximity = T, tuneRF = T)

Model_RF_UP_BC

##
## Call:
##   randomForest(formula = Class ~ . - State - Country, data = Train_UP_BC,      mtry = 7, ntree = 500,
##                 Type of random forest: classification
##                 Number of trees: 500
## No. of variables tried at each split: 7
##
##           OOB estimate of  error rate: 14.24%
## Confusion matrix:
##             Detractor Promotor class.error
## Detractor      2315       346   0.1300263
## Promotor        412      2249   0.1548290

Y_Predict_UP_BC_RF = predict(Model_RF_UP_BC, newdata = Test_UP_BC, type = "response")

Conf_Mat_RF_UP_BC = confusionMatrix(Test_UP_BC$Class, as.factor(Y_Predict_UP_BC_RF))

Accuracy_RF_UP_BC = Conf_Mat_RF_UP_BC$overall[1]

Accuracy_RF_UP_BC

```

```

## Accuracy
## 0.7221408

Model_Boost_UP_BC = adaboost(Class ~ ., data = Train_UP_BC, 10)

Y_Predict_AB_UP_BC = predict(Model_Boost_UP_BC, newdata = Test_UP_BC, type = "response")

Conf_Mat_AB_UP_BC = confusionMatrix(Test_UP_BC$Class, Y_Predict_AB_UP_BC$class)

```

```

Accuracy_AB_UP_BC = Conf_Mat_AB_UP_BC$overall[1]

Accuracy_AB_UP_BC

## Accuracy
## 0.686217

Model_RF_SMOTE_BC = randomForest(NPS_Status ~ . - State - Country, data = Train_SMOTE_BC,
                                  mtry = 7, ntree = 500, importance = T, proximity = T, tuneRF = T)

Model_RF_SMOTE_BC

##
## Call:
##   randomForest(formula = NPS_Status ~ . - State - Country, data = Train_SMOTE_BC,      mtry = 7, ntre
##   Type of random forest: classification
##   Number of trees: 500
##   No. of variables tried at each split: 7
##
##   OOB estimate of  error rate: 10.14%
## Confusion matrix:
##             Detractor Promotor class.error
## Detractor        924     781 0.458064516
## Promotor         53     6463 0.008133824

Y_Predict_SMOTE_BC_RF = predict(Model_RF_SMOTE_BC, newdata = Test_SMOTE_BC,
                                 type = "response")

Conf_Mat_RF_SMOTE_BC = confusionMatrix(Test_SMOTE_BC$NPS_Status, Y_Predict_SMOTE_BC_RF)

Accuracy_RF_SMOTE_BC = Conf_Mat_RF_SMOTE_BC$overall[1]

Accuracy_RF_SMOTE_BC

## Accuracy
## 0.8215031

Model_Boost = adaboost(NPS_Status ~ ., data = Train_SMOTE_BC, 10)

Y_Predict_AB = predict(Model_Boost, newdata = Test_SMOTE_BC, type = "response")

Conf_Mat_AB_SMOTE_BC = confusionMatrix(Test_SMOTE_BC$NPS_Status, Y_Predict_AB$class)

Accuracy_AB_SMOTE_BC = Conf_Mat_AB_SMOTE_BC$overall[1]

Accuracy_AB_SMOTE_BC

## Accuracy
## 0.7969729

```

We get Accuracy of 0.7335958 accuracy with random forest and 0.6889764 with Adaboost on our binary data with Down Sampling.

We get Accuracy of 0.7221408 accuracy with random forest and 0.686217 with Adaboost on our binary data Up Sampling.

We get Accuracy of 0.8215031 accuracy with random forest and 0.7969729 with Adaboost on our binary data with SMOTE Sampling.

Up Sampling, Down Sampling and SMOTE for MultiClass Data:

Random Forest and Ada-Boost and the sampled Data:

```
Train_UP_MC = upSample(x = Train_MC[, -ncol(Train_MC)], y = Train_MC$NPS_Status)

Train_Down_MC = downSample(x = Train_MC[, -ncol(Train_MC)], y = Train_MC$NPS_Status)

Test_UP_MC = upSample(x = Test_MC[, -ncol(Test_MC)], y = Test_MC$NPS_Status)

Test_Down_MC = downSample(x = Test_MC[, -ncol(Test_MC)], y = Test_MC$NPS_Status)

Train_SMOTE_MC = SMOTE(NPS_Status ~ ., data = Train_MC, k = 5)

Train_SMOTE_MC = na.omit(Train_SMOTE_MC)

Test_SMOTE_MC = SMOTE(NPS_Status ~ ., data = Test_MC)

Test_SMOTE_MC = na.omit(Test_SMOTE_MC)

Model_RF_Down_MC = randomForest(Class ~ . - Country, data = Train_Down_MC, mtry = 7,
                                 ntree = 500, importance = T, proximity = T, tuneRF = T)

Model_RF_Down_MC

## 
## Call:
##   randomForest(formula = Class ~ . - Country, data = Train_Down_MC,      mtry = 7, ntree = 500, import
##                 Type of random forest: classification
##                 Number of trees: 500
## No. of variables tried at each split: 7
##
##                 OOB estimate of error rate: 40.06%
## Confusion matrix:
##             Detractor Passive Promotor class.error
## Detractor       296      95      55  0.3363229
## Passive         107     199     140  0.5538117
## Promotor        32      107     307  0.3116592
```

```

Y_Predict_Down_MC_RF = predict(Model_RF_Down_MC, newdata = Test_Down_MC, type = "class")

Conf_Mat_RF_Down_MC = confusionMatrix(Test_Down_MC$Class, as.factor(Y_Predict_Down_MC_RF))

Accuracy_RF_Down_MC = Conf_Mat_RF_Down_MC$overall[1]

Accuracy_RF_Down_MC

## Accuracy
## 0.6333333

Model_Boost_Down_MC = boosting(Class ~ ., data = Train_Down_MC, boos = TRUE)

Y_Predict_AB_Down_MC = predict(Model_Boost_Down_MC, newdata = Test_Down_MC,
                                type = "class")

Conf_Mat_AB_Down_MC = confusionMatrix(Test_Down_MC$Class, as.factor(Y_Predict_AB_Down_MC[["class"]]))

Accuracy_AB_Down_MC = Conf_Mat_AB_Down_MC$overall[1]

Accuracy_AB_Down_MC

## Accuracy
## 0.6

Model_RF_UP_MC = randomForest(Class ~ . - Country, data = Train_UP_MC, mtry = 7,
                               ntree = 500, importance = T, proximity = T, tuneRF = T)

Model_RF_UP_MC

##
## Call:
##   randomForest(formula = Class ~ . - Country, data = Train_UP_MC,      mtry = 7, ntree = 500, importance
##                 Type of random forest: classification
##                           Number of trees: 500
##   No. of variables tried at each split: 7
##
##           OOB estimate of  error rate: 8.05%
## Confusion matrix:
##             Detractor Passive Promotor class.error
## Detractor      2640       3       4 0.002644503
## Passive        23     2415     209 0.087646392
## Promotor       26     374    2247 0.151114469

Y_Predict_UP_MC_RF = predict(Model_RF_UP_MC, newdata = Test_UP_MC, type = "response")

Conf_Mat_RF_UP_MC = confusionMatrix(Test_UP_MC$Class, as.factor(Y_Predict_UP_MC_RF))

Accuracy_RF_UP_MC = Conf_Mat_RF_UP_MC$overall[1]

Accuracy_RF_UP_MC

```

```

## Accuracy
## 0.6187739

Model_Boost_UP_MC = boosting(Class ~ ., data = Train_UP_MC, boos = TRUE)

Y_Predict_AB_UP_MC = predict(Model_Boost_UP_MC, newdata = Test_UP_MC, type = "response")

Conf_Mat_AB_UP_MC = confusionMatrix(Test_UP_MC$Class, as.factor(Y_Predict_AB_UP_MC$class))

Accuracy_AB_UP_MC = Conf_Mat_AB_UP_MC$overall[1]

Accuracy_AB_UP_MC

```

```

## Accuracy
## 0.5818966

```

```

Model_RF_SMOTE_MC = randomForest(NPS_Status ~ . - Country, data = Train_SMOTE_MC,
  mtry = 7, ntree = 500, importance = T, proximity = T, tuneRF = T)

```

```

Model_RF_SMOTE_MC

```

```

##
## Call:
##   randomForest(formula = NPS_Status ~ . - Country, data = Train_SMOTE_MC,      mtry = 7, ntree = 500,
##                 Type of random forest: classification
##                 Number of trees: 500
##   No. of variables tried at each split: 7
##
##           OOB estimate of error rate: 23.56%
## Confusion matrix:
##             Detractor Passive Promotor class.error
## Detractor      273      71     105  0.39198218
## Passive        62     301     197  0.46250000
## Promotor       27      64    1133  0.07434641

```

```

Y_Predict_SMOTE_MC_RF = predict(Model_RF_SMOTE_MC, newdata = Test_SMOTE_MC,
  type = "response")

```

```

Conf_Mat_RF_SMOTE_MC = confusionMatrix(Test_SMOTE_MC$NPS_Status, as.factor(Y_Predict_SMOTE_MC_RF))

```

```

Accuracy_RF_SMOTE_MC = Conf_Mat_RF_SMOTE_MC$overall[1]

```

```

Accuracy_RF_SMOTE_MC

```

```

## Accuracy
## 0.693837

```

```

Model_Boost_SMOTE_MC = boosting(NPS_Status ~ ., data = Train_SMOTE_MC, boos = TRUE)

```

```

Y_Predict_AB_SMOTE_MC = predict(Model_Boost_SMOTE_MC, newdata = Test_SMOTE_MC,
  type = "response")

```

```

Conf_Mat_AB_SMOTE_MC = confusionMatrix(Test_SMOTE_MC$NPS_Status, as.factor(Y_Predict_AB_SMOTE_MC$class))

Accuracy_AB_SMOTE_MC = Conf_Mat_AB_SMOTE_MC$overall[1]

Accuracy_AB_SMOTE_MC

## Accuracy
## 0.6978131

```

We get Accuracy of 0.6333333 accuracy with random forest and 0.6 with Adaboost on our Multiclass data with Down Sampling.

We get Accuracy of 0.6187739 accuracy with random forest and 0.5818966 with Adaboost on our Multiclass data with Up Sampling.

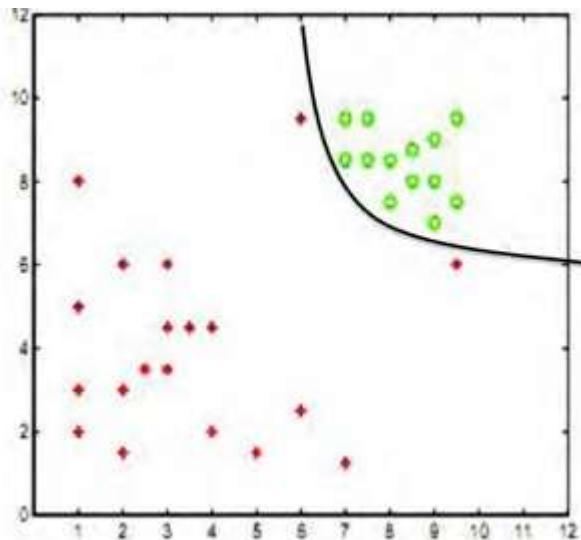
We get Accuracy of 0.693837 accuracy with random forest and 0.6978131 with Adaboost on our Multiclass data with SMOTE Sampling.

Part 9

According to us, the balanced data using SMOTE and applying the random forest will give us the best measure of success. And using that model, these variables are the highest influencing variables in our prediction of our NPS_Score:- CE_VALUEFORMONEY, EM_IMMEDIATEATTENTION, Estimatedcost, Department, BedCategory, AgeYrs, LengthofStay

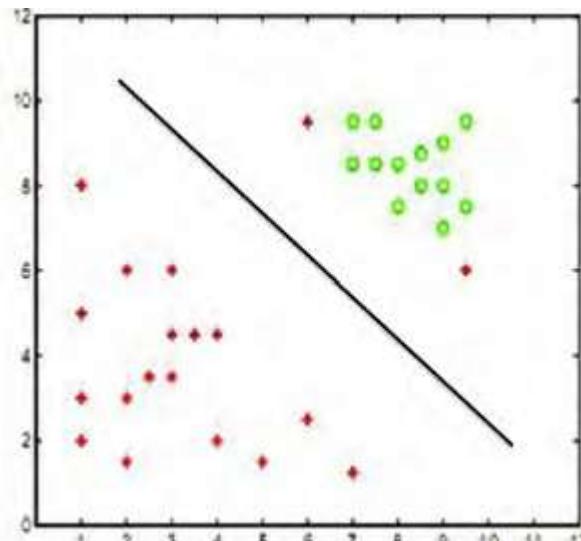
Question 2:

Part a



Since C i.e. our cost of missclassification is too large, we can't afford any misclassification. We will choose a parabola such that there is no training error that will be the one with the minimum curvature.

Part b



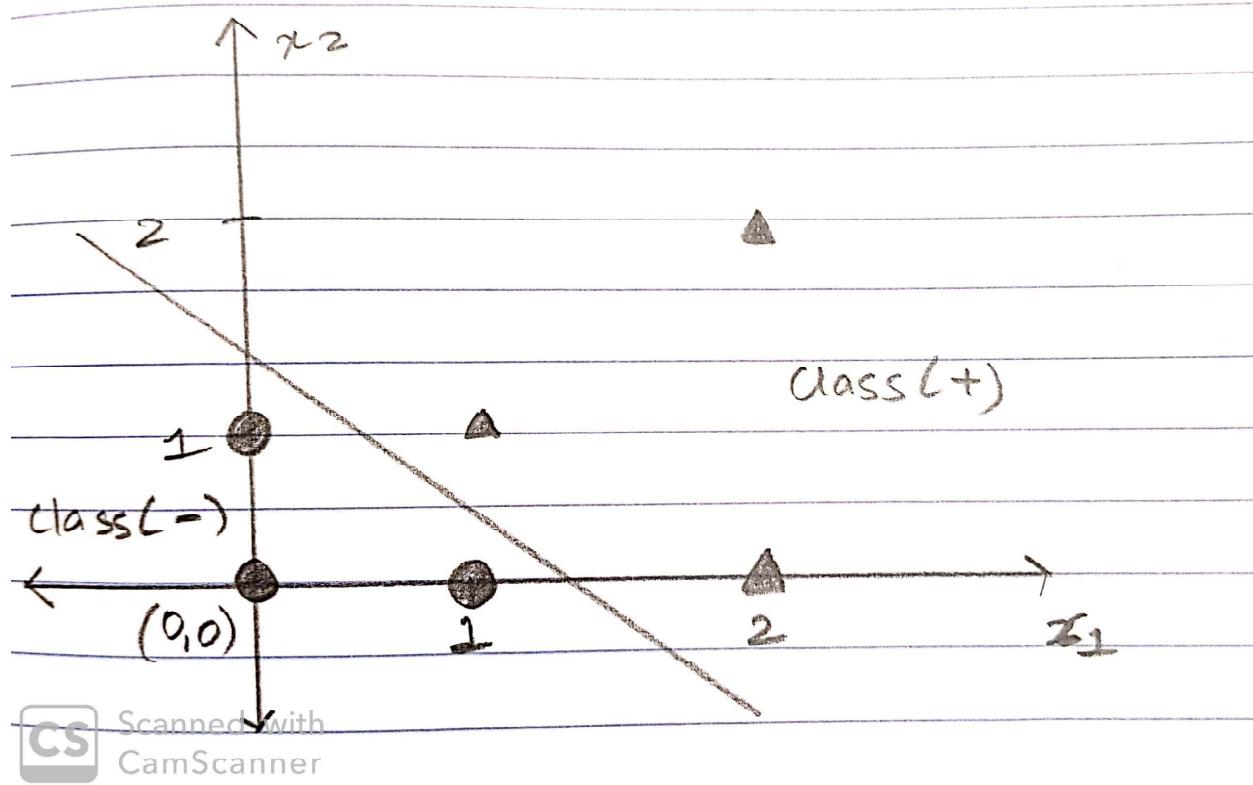
Since the cost of mis-classification is too small, the decision boundary will be linear.

Part c

Overfitting. If we use a 5-degree kernel, which is a very complex model , it will definitely overfit the training data. So any new point has a high chance of being miss-classified as we use soft-margin.

Question 3:

Part a



Part b

The maximum margin hyperplane is downward sloping and it should have a slope of -1.

So,

$$w_1 x_1 + w_2 x_2 + b = 0 \quad \dots \quad (1.1)$$

We need 3 equations as there are 3 parameters:-

$$w_1 + b = 0 \quad \dots \quad (1)$$

$$w_2 + b = 0 \quad \dots \quad (2)$$

$$w_1 + w_2 + b = 0 \quad \dots \quad (3)$$

Solving these and inserting in 1.1, we get that our slope should satisfy

$$x_1 = \frac{3}{2} \text{ and } x_2 = 0.$$

So, the equation is :-

$$x_1 + x_2 = \frac{3}{2}$$

The weights are 1 & 1 for w_1 & w_2 respectively.

So the weight vectors are $(1, 1)^T$.



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Part c

The optimal margin increases when we remove the support vectors $(1, 0)$ or $(1, 1)$ and stays the same when we remove the other two support vectors $(2, 0)$ or $(0, 1)$.