Tema5_Ejercicio_Weka_version

Fran Camacho

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Tema 5 - Ejercicio

El dataset Carseats incluido en la librería ISLR incluye datos relativos a las ventas de sillitas de coche para niños de 400 establecimientos. Puede encontrarse información detallada sobre cada variable incluida el dataset en https://www.rdocumentation.org/packages/ISLR/versions/1.4/topics/Carseats.

Usando dicho dataset, construya un árbol de decisión, utilizando un 75% de la muestra como conjunto de entrenamiento, para predecir la variable Sales en base al resto de variables e interprete los resultados, comentando las reglas obtenidas.

Para realizar esta prueba, previamente se recomienda convertir Sales en una variable categórica usando la función ifelse. Para ello, será necesario establecer un punto de corte usando algún criterio predefinido (ie, valor por encima o por debajo de la media o la mediana).

Paso 1: Carga de los datos

```
#Load data from CRAN package ISLR
#install.packages("ISLR")
library("ISLR")
```

Paso 2: Explorar y preparar los datos. Uso de rJava y RWeka

En lugar de utilizar el algoritmo C5.0, vamos a experimentar con el algoritmo equivalente J48 de Weka (R/Weka Classifier Trees)

```
if (!require(RWeka)) install.packages('RWeka', dependencies = T)    # Decision trees RWeka algorithm
```

```
## Cargando paquete requerido: RWeka
```

```
library(RWeka)

#install.packages("MultiBoostAB")  # Installed with WPM
#library(MultiBoostAB)

if (!require(caret)) install.packages('caret', dependencies = T)    # data partitioning, confusion matri
```

```
## Cargando paquete requerido: caret
```

```
## Cargando paquete requerido: ggplot2
```

```
## Cargando paquete requerido: lattice
```

```r
library(caret)
```

Mismos pasos:

Pasar de sales a salesFactor

```r
#Summary
sales_mean <- mean(Carseats$Sales)  # mean and median are almost the same

Carseats$SalesFactor <- factor(ifelse(Carseats$Sales>sales_mean,"Yes","No"))
```

Eliminar sales

```r
#Remove sales variable
CarseatsNew <- Carseats[-1]
```

Conjuntos de entrenamiento y test

```r
#Set seed to make the process reproducible
set.seed(9)

#partitioning data frame into training (75%) and testing (25%) sets
train_indices <- createDataPartition(CarseatsNew$SalesFactor, times=1, p=.75, list=FALSE)

#create training set
CarseatsNew_train <- CarseatsNew[train_indices, ]

#create testing set
CarseatsNew_test  <- CarseatsNew[-train_indices, ]

#create labels sets
CarseatsNew_train_labels <- CarseatsNew[train_indices, ]$SalesFactor
CarseatsNew_test_labels <- CarseatsNew[-train_indices, ]$SalesFactor

#view number of rows in each set
#nrow(CarseatsNew_train)  # 301
#nrow(CarseatsNew_test)   # 99
#length(CarseatsNew_train_labels)  # 301
#length(CarseatsNew_test_labels)   # 99
```

Paso 3: Entrenamiento del modelo

```r
# For the first iteration of the model, we use the default C5.0 settings

sales_model <- J48(SalesFactor ~ ., data = CarseatsNew_train)

sales_model
```

```
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad
## |   Price <= 102
## |   |   Income <= 50: No (8.0/1.0)
## |   |   Income > 50: Yes (15.0/3.0)
## |   Price > 102
## |   |   Age <= 59
## |   |   |   Price <= 125
## |   |   |   |   Advertising <= 10: No (8.0/1.0)
## |   |   |   |   Advertising > 10: Yes (4.0)
## |   |   |   Price > 125: No (20.0/1.0)
## |   |   Age > 59: No (18.0)
## ShelveLoc = Good
## |   Price <= 135: Yes (51.0/1.0)
## |   Price > 135
## |   |   Urban = No: No (3.0)
## |   |   Urban = Yes
## |   |   |   Price <= 156: Yes (6.0/1.0)
## |   |   |   Price > 156: No (3.0)
## ShelveLoc = Medium
## |   Price <= 105
## |   |   Advertising <= 6
## |   |   |   Price <= 84: Yes (8.0)
## |   |   |   Price > 84
## |   |   |   |   CompPrice <= 125
## |   |   |   |   |   Price <= 100
## |   |   |   |   |   |   Price <= 97: No (7.0/1.0)
## |   |   |   |   |   |   Price > 97: Yes (4.0)
## |   |   |   |   |   Price > 100: No (6.0)
## |   |   |   |   CompPrice > 125: Yes (5.0)
## |   |   Advertising > 6: Yes (26.0/1.0)
## |   Price > 105
## |   |   CompPrice <= 122: No (35.0/3.0)
## |   |   CompPrice > 122
## |   |   |   Price <= 127
## |   |   |   |   Advertising <= 10
## |   |   |   |   |   US = No
## |   |   |   |   |   |   Advertising <= 1
## |   |   |   |   |   |   |   CompPrice <= 141
## |   |   |   |   |   |   |   |   Age <= 33: Yes (2.0)
## |   |   |   |   |   |   |   |   Age > 33: No (8.0/1.0)
## |   |   |   |   |   |   |   CompPrice > 141: Yes (4.0)
## |   |   |   |   |   |   Advertising > 1: Yes (2.0)
## |   |   |   |   |   US = Yes: No (4.0)
## |   |   |   |   Advertising > 10: Yes (13.0)
## |   |   |   Price > 127
## |   |   |   |   CompPrice <= 142: No (28.0/1.0)
## |   |   |   |   CompPrice > 142
## |   |   |   |   |   Advertising <= 7
## |   |   |   |   |   |   CompPrice <= 149: Yes (3.0/1.0)
## |   |   |   |   |   |   CompPrice > 149: No (5.0)
## |   |   |   |   |   Advertising > 7: Yes (5.0)
```

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```
## 
## Number of Leaves  :   27
## 
## Size of the tree :    52
```

En comparación con la versión de R, el tamaño es bastante mayor (en R es 19) (Por defecto el podado de ramas está activado, para intentar evitar el sobreajuste).

```
# To see the tree's decisions, we can call the summary() function on the model:

summary(sales_model)
```

```
## 
## === Summary ===
## 
## Correctly Classified Instances         285                    94.6844 %
## Incorrectly Classified Instances        16                     5.3156 %
## Kappa statistic                          0.8937
## Mean absolute error                      0.0929
## Root mean squared error                  0.2155
## Relative absolute error                 18.5799 %
## Root relative squared error             43.1044 %
## Total Number of Instances              301
## 
## === Confusion Matrix ===
## 
##    a   b   <-- classified as
## 144   7 |   a = No
##    9 141 |   b = Yes
```

Paso 4: Evaluación del modelo

Realizamos la predicción con los datos nuevos.

```
#Prediction

sales_pred <- predict(sales_model, CarseatsNew_test)
```

Y comparamos lo predicho por el algoritmo con los datos etiquetados anteriormente

```
#confusion matrix
confusionMatrix(reference = CarseatsNew_test_labels, data = sales_pred, mode = "everything", positive =
```

```
## Confusion Matrix and Statistics
## 
##           Reference
## Prediction No Yes
##        No  37  15
##        Yes 13  34
## 
##                Accuracy : 0.7172
```

```
##               95% CI : (0.6178, 0.8031)
##      No Information Rate : 0.5051
##      P-Value [Acc > NIR] : 1.419e-05
##
##                    Kappa : 0.4341
##
##  Mcnemar's Test P-Value : 0.8501
##
##              Sensitivity : 0.6939
##              Specificity : 0.7400
##           Pos Pred Value : 0.7234
##           Neg Pred Value : 0.7115
##                Precision : 0.7234
##                   Recall : 0.6939
##                       F1 : 0.7083
##               Prevalence : 0.4949
##           Detection Rate : 0.3434
##    Detection Prevalence : 0.4747
##        Balanced Accuracy : 0.7169
##
##         'Positive' Class : Yes
##
```

Se obtiene un resultado ligeramente inferior al obtenido en R.

Paso 5: Mejora del modelo

```
# ## Learn J4.8 tree with reduced error pruning (-R) and minimum number of instances per leaf set to 10
# ## Learn J4.8 unpruned tree (U) and minimum number of instances per leaf set to 10 (-M 10)
# To see wich options can be used
# > WOW(J48)

sales_model_2<- J48(SalesFactor ~ ., data = CarseatsNew_train, control = Weka_control(M = 10))

sales_model_2
```

```
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad
## |   Price <= 102
## |   |   Income <= 74: No (12.0/4.0)
## |   |   Income > 74: Yes (11.0/2.0)
## |   Price > 102: No (50.0/6.0)
## ShelveLoc = Good
## |   Price <= 135: Yes (51.0/1.0)
## |   Price > 135: No (12.0/5.0)
## ShelveLoc = Medium
## |   Price <= 105: Yes (56.0/13.0)
## |   Price > 105
## |   |   CompPrice <= 122: No (35.0/3.0)
```

```
## |   |   CompPrice > 122
## |   |   |   Price <= 127
## |   |   |   |   Advertising <= 10
## |   |   |   |   |   Age <= 50: Yes (10.0/3.0)
## |   |   |   |   |   Age > 50: No (10.0/2.0)
## |   |   |   |   Advertising > 10: Yes (13.0)
## |   |   |   Price > 127
## |   |   |   |   CompPrice <= 142: No (28.0/1.0)
## |   |   |   |   CompPrice > 142: Yes (13.0/6.0)
##
## Number of Leaves  :  12
##
## Size of the tree :   22
```

Predicción

```
#Prediction
```

```
sales_pred2 <- predict(sales_model_2, CarseatsNew_test)
```

Y comparamos lo predicho por el algoritmo con los datos etiquetados anteriormente

```
#confusion matrix
confusionMatrix(reference = CarseatsNew_test_labels, data = sales_pred2, mode = "everything", positive =
```

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction No Yes
##        No  34   9
##        Yes 16  40
##
##               Accuracy : 0.7475
##                 95% CI : (0.6502, 0.8294)
##    No Information Rate : 0.5051
##    P-Value [Acc > NIR] : 7.008e-07
##
##                  Kappa : 0.4956
##
##  Mcnemar's Test P-Value : 0.2301
##
##            Sensitivity : 0.8163
##            Specificity : 0.6800
##         Pos Pred Value : 0.7143
##         Neg Pred Value : 0.7907
##              Precision : 0.7143
##                 Recall : 0.8163
##                     F1 : 0.7619
##             Prevalence : 0.4949
##         Detection Rate : 0.4040
##   Detection Prevalence : 0.5657
##      Balanced Accuracy : 0.7482
##
```

```
##           'Positive' Class : Yes
##
```

Jugando con varios parámetros, solo consigo igualar los resultados de R.

Veamos aplicando **boosting**:

```
# AdaBoostM1

#sales_model_adaboost <- AdaBoostM1(SalesFactor ~ ., data = CarseatsNew_train, control = Weka_control(W
sales_model_adaboost <- AdaBoostM1(SalesFactor ~ ., data = CarseatsNew_train, control = Weka_control(I =

sales_model_adaboost
```

```
## AdaBoostM1: Base classifiers and their weights:
##
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad
## |   Price <= 102
## |   |   Income <= 74: No (12.0/4.0)
## |   |   Income > 74: Yes (11.0/2.0)
## |   Price > 102: No (50.0/6.0)
## ShelveLoc = Good
## |   Price <= 135: Yes (51.0/1.0)
## |   Price > 135: No (12.0/5.0)
## ShelveLoc = Medium
## |   Price <= 105: Yes (56.0/13.0)
## |   Price > 105
## |   |   CompPrice <= 122: No (35.0/3.0)
## |   |   CompPrice > 122
## |   |   |   Price <= 127
## |   |   |   |   Advertising <= 10
## |   |   |   |   |   Age <= 50: Yes (10.0/3.0)
## |   |   |   |   |   Age > 50: No (10.0/2.0)
## |   |   |   |   Advertising > 10: Yes (13.0)
## |   |   |   Price > 127
## |   |   |   |   CompPrice <= 142: No (28.0/1.0)
## |   |   |   |   CompPrice > 142: Yes (13.0/6.0)
##
## Number of Leaves  :   12
##
## Size of the tree :   22
##
##
## Weight: 1.71
##
## J48 pruned tree
## ------------------
##
## Age <= 73
## |   ShelveLoc = Bad
## |   |   Price <= 129
```

```
## |   |   |   Age <= 43: Yes (38.89/7.08)
## |   |   |   Age > 43: No (15.4/5.04)
## |   |   Price > 129: No (10.03)
## |   ShelveLoc = Good: Yes (50.32/5.63)
## |   ShelveLoc = Medium
## |   |   Advertising <= 10
## |   |   |   CompPrice <= 129
## |   |   |   |   Price <= 90: Yes (10.35/3.27)
## |   |   |   |   Price > 90: No (58.15/9.17)
## |   |   |   CompPrice > 129
## |   |   |   |   Price <= 124: Yes (10.35/1.18)
## |   |   |   |   Price > 124: No (32.35/5.63)
## |   |   Advertising > 10
## |   |   |   Age <= 35: Yes (10.67)
## |   |   |   Age > 35
## |   |   |   |   Price <= 118: Yes (17.76/3.86)
## |   |   |   |   Price > 118: No (12.98/4.13)
## Age > 73: No (33.74/3.54)
##
## Number of Leaves  :  12
##
## Size of the tree :   22
##
##
## Weight: 1.65
##
## J48 pruned tree
## ------------------
##
## CompPrice <= 109
## |   Income <= 40: No (26.05)
## |   Income > 40
## |   |   Advertising <= 8: No (24.12/4.77)
## |   |   Advertising > 8: Yes (12.46/3.17)
## CompPrice > 109
## |   Population <= 178
## |   |   Advertising <= 8
## |   |   |   ShelveLoc = Bad: No (17.97/3.9)
## |   |   |   ShelveLoc = Good: Yes (8.19/1.83)
## |   |   |   ShelveLoc = Medium: No (33.86/5.42)
## |   |   Advertising > 8: Yes (11.05/2.81)
## |   Population > 178
## |   |   Price <= 126: Yes (112.97/21.77)
## |   |   Price > 126
## |   |   |   ShelveLoc = Bad: No (11.89)
## |   |   |   ShelveLoc = Good: Yes (13.73/4.36)
## |   |   |   ShelveLoc = Medium
## |   |   |   |   Advertising <= 7: No (12.13/3.66)
## |   |   |   |   Advertising > 7: Yes (16.57/3.52)
##
## Number of Leaves  :  12
##
## Size of the tree :   21
##
```

```
## 
## Weight: 1.49
## 
## J48 pruned tree
## ------------------
## 
## Price <= 81: Yes (18.58/0.43)
## Price > 81
## |   CompPrice <= 131
## |   |   Price <= 134
## |   |   |   Income <= 100
## |   |   |   |   ShelveLoc = Bad: No (36.01/2.75)
## |   |   |   |   ShelveLoc = Good: Yes (12.76/6.21)
## |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   Age <= 47: Yes (24.74/8.81)
## |   |   |   |   |   Age > 47: No (74.13/10.25)
## |   |   |   Income > 100: Yes (10.59/1.61)
## |   |   Price > 134: No (16.56)
## |   CompPrice > 131
## |   |   Price <= 144: Yes (84.34/20.2)
## |   |   Price > 144: No (23.3/5.82)
## 
## Number of Leaves  :  9
## 
## Size of the tree :   16
## 
## 
## Weight: 1.47
## 
## J48 pruned tree
## ------------------
## 
## Price <= 100
## |   Education <= 12: Yes (24.06/1.73)
## |   Education > 12
## |   |   Price <= 92: Yes (22.98/6.35)
## |   |   Price > 92: No (11.5/2.04)
## Price > 100
## |   CompPrice <= 142
## |   |   Advertising <= 5: No (105.54/6.96)
## |   |   Advertising > 5
## |   |   |   ShelveLoc = Bad: No (15.54/7.68)
## |   |   |   ShelveLoc = Good: Yes (7.96/0.69)
## |   |   |   ShelveLoc = Medium
## |   |   |   |   CompPrice <= 112: No (16.28/0.4)
## |   |   |   |   CompPrice > 112
## |   |   |   |   |   Price <= 127
## |   |   |   |   |   |   Price <= 111: No (15.73/5.4)
## |   |   |   |   |   |   Price > 111: Yes (15.93/0.59)
## |   |   |   |   |   Price > 127: No (16.34/1.47)
## |   CompPrice > 142: Yes (49.14/14.25)
## 
## Number of Leaves  :  11
## 
```

```
## Size of the tree :    20
##
##
## Weight: 1.67
##
## J48 pruned tree
## ------------------
##
## Advertising <= 14
## |    Price <= 126
## |    |    CompPrice <= 109: No (44.22/6.55)
## |    |    CompPrice > 109
## |    |    |    ShelveLoc = Bad
## |    |    |    |    CompPrice <= 123: No (11.45/1.6)
## |    |    |    |    CompPrice > 123: Yes (11.05/2.93)
## |    |    |    ShelveLoc = Good: Yes (5.45)
## |    |    |    ShelveLoc = Medium
## |    |    |    |    Advertising <= 6
## |    |    |    |    |    Income <= 101
## |    |    |    |    |    |    Urban = No: No (18.13/3.96)
## |    |    |    |    |    |    Urban = Yes
## |    |    |    |    |    |    |    CompPrice <= 125: No (22.28/8.05)
## |    |    |    |    |    |    |    CompPrice > 125: Yes (17.64/5.91)
## |    |    |    |    |    Income > 101: Yes (15.43/1.37)
## |    |    |    |    Advertising > 6: Yes (22.51/2.37)
## |    Price > 126
## |    |    Income <= 82: No (65.27/4.08)
## |    |    Income > 82: Yes (19.4/9.05)
## Advertising > 14
## |    Age <= 60: Yes (37.95/2.66)
## |    Age > 60: No (10.21/3.68)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
##
##
## Weight: 1.56
##
## J48 pruned tree
## ------------------
##
## Population <= 491
## |    Advertising <= 13
## |    |    Price <= 104
## |    |    |    Advertising <= 7
## |    |    |    |    ShelveLoc = Bad: No (11.9/4.12)
## |    |    |    |    ShelveLoc = Good: Yes (1.64)
## |    |    |    |    ShelveLoc = Medium
## |    |    |    |    |    Advertising <= 0: No (20.16/8.33)
## |    |    |    |    |    Advertising > 0: Yes (15.5/2.87)
## |    |    |    Advertising > 7: Yes (13.97/0.68)
## |    |    Price > 104
## |    |    |    Price <= 156
```

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```
## |   |   |   |       CompPrice <= 150
## |   |   |   |   |   ShelveLoc = Bad: No (17.17/1.41)
## |   |   |   |   |   ShelveLoc = Good
## |   |   |   |   |   |   Age <= 42: No (12.27/1.03)
## |   |   |   |   |   |   Age > 42: Yes (10.09/2.45)
## |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   Age <= 33: Yes (20.26/5.58)
## |   |   |   |   |   |   Age > 33: No (67.57/8.28)
## |   |   |   |   CompPrice > 150: Yes (15.83/5.76)
## |   |   |   Price > 156: No (18.39)
## |   Advertising > 13
## |   |   ShelveLoc = Bad: Yes (14.14/0.53)
## |   |   ShelveLoc = Good: Yes (2.96)
## |   |   ShelveLoc = Medium
## |   |   |   CompPrice <= 122: No (14.27/3.32)
## |   |   |   CompPrice > 122: Yes (15.86/1.93)
## Population > 491: Yes (29.01/1.85)
##
## Number of Leaves  :   17
##
## Size of the tree :    30
##
##
## Weight: 1.66
##
## J48 pruned tree
## ------------------
##
## Age <= 76
## |   Price <= 109
## |   |   Price <= 70: Yes (21.26)
## |   |   Price > 70
## |   |   |   Urban = No: Yes (28.26/4.26)
## |   |   |   Urban = Yes
## |   |   |   |   CompPrice <= 121
## |   |   |   |   |   Price <= 98: No (14.94/2.02)
## |   |   |   |   |   Price > 98: Yes (19.14/3.81)
## |   |   |   |   CompPrice > 121: Yes (21.97/0.82)
## |   Price > 109
## |   |   CompPrice <= 114: No (28.43/1.03)
## |   |   CompPrice > 114
## |   |   |   Price <= 149
## |   |   |   |   ShelveLoc = Bad
## |   |   |   |   |   Advertising <= 10: No (33.23/4.14)
## |   |   |   |   |   Advertising > 10: Yes (10.76/1.72)
## |   |   |   |   ShelveLoc = Good: Yes (5.83)
## |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   Income <= 29: Yes (17.59/1.47)
## |   |   |   |   |   Income > 29
## |   |   |   |   |   |   US = No
## |   |   |   |   |   |   |   Advertising <= 2
## |   |   |   |   |   |   |   |   Urban = No: Yes (11.41/3.79)
## |   |   |   |   |   |   |   |   Urban = Yes: No (11.79/1.57)
## |   |   |   |   |   |   |   Advertising > 2: Yes (12.49/0.15)
```

```
## |   |   |   |   |   |     US = Yes: No (27.25/7.18)
## |   |   |   Price > 149: No (18.86/2.66)
## Age > 76: No (17.79/1.49)
##
## Number of Leaves  :   16
##
## Size of the tree :    30
##
##
## Weight: 1.99
##
## J48 pruned tree
## ------------------
##
## Price <= 80: Yes (18.62/0.37)
## Price > 80
## |   Urban = No
## |   |   Income <= 65: No (50.5/3.04)
## |   |   Income > 65
## |   |   |   Population <= 133: No (11.62/0.57)
## |   |   |   Population > 133: Yes (24.31/2.89)
## |   Urban = Yes
## |   |   Advertising <= 21
## |   |   |   CompPrice <= 159
## |   |   |   |   CompPrice <= 121
## |   |   |   |   |   ShelveLoc = Bad: No (10.68/2.51)
## |   |   |   |   |   ShelveLoc = Good: Yes (7.24/0.38)
## |   |   |   |   |   ShelveLoc = Medium: No (40.58/10.81)
## |   |   |   |   CompPrice > 121
## |   |   |   |   |   Education <= 10: Yes (16.53/0.02)
## |   |   |   |   |   Education > 10
## |   |   |   |   |   |   Price <= 129: Yes (74.9/13.63)
## |   |   |   |   |   |   Price > 129
## |   |   |   |   |   |   |   Age <= 59: No (14.02/0.56)
## |   |   |   |   |   |   |   Age > 59: Yes (10.64/3.97)
## |   |   |   CompPrice > 159: No (10.7)
## |   |   Advertising > 21: Yes (10.66)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
##
##
## Weight: 1.91
##
## J48 pruned tree
## ------------------
##
## Price <= 102
## |   Age <= 68: Yes (76.99/7.95)
## |   Age > 68: No (10.89/3.92)
## Price > 102
## |   Advertising <= 0
## |   |   CompPrice <= 143: No (68.45/5.06)
```

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## |   |       CompPrice > 143: Yes (10.5/2.98)
## |   Advertising > 0
## |   |   Population <= 393
## |   |   |   Population <= 276
## |   |   |   |   Urban = No: No (10.47/2.15)
## |   |   |   |   Urban = Yes
## |   |   |   |   |   Income <= 76: Yes (26.08/2.7)
## |   |   |   |   |   Income > 76: No (13.19/3.6)
## |   |   |   Population > 276: No (45.57/4.02)
## |   |   Population > 393: Yes (38.87/8.34)
##
## Number of Leaves  :   9
##
## Size of the tree :    17
##
##
## Weight: 1.85
##
## J48 pruned tree
## ------------------
##
## Price <= 139
## |   Income <= 100
## |   |   Advertising <= 0
## |   |   |   Income <= 48: No (20.11/1.45)
## |   |   |   Income > 48
## |   |   |   |   CompPrice <= 132: No (38.93/9.68)
## |   |   |   |   CompPrice > 132: Yes (14.36/4.39)
## |   |   Advertising > 0
## |   |   |   Population <= 276: Yes (74.89/15.86)
## |   |   |   Population > 276
## |   |   |   |   ShelveLoc = Bad: No (17.54/0.71)
## |   |   |   |   ShelveLoc = Good: Yes (8.27)
## |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   Age <= 39: Yes (14.57/0.82)
## |   |   |   |   |   Age > 39: No (32.35/4.99)
## |   Income > 100: Yes (35.42/3.73)
## Price > 139: No (44.56/5.2)
##
## Number of Leaves  :   10
##
## Size of the tree :    18
##
##
## Weight: 1.69
##
## J48 pruned tree
## ------------------
##
## Population <= 491
## |   ShelveLoc = Bad
## |   |   Age <= 43: Yes (17.97/6.75)
## |   |   Age > 43
## |   |   |   Age <= 57: No (21.48)
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## |   |   |   Age > 57
## |   |   |   |   Education <= 14: No (16.47/0.5)
## |   |   |   |   Education > 14: Yes (11.28/4.35)
## |   ShelveLoc = Good
## |   |   Income <= 42: No (11.42/2.39)
## |   |   Income > 42: Yes (26.01/0.85)
## |   ShelveLoc = Medium
## |   |   Education <= 10: Yes (17.47/3.9)
## |   |   Education > 10
## |   |   |   Price <= 104
## |   |   |   |   Urban = No: Yes (12.36/1.39)
## |   |   |   |   Urban = Yes
## |   |   |   |   |   Population <= 161: Yes (14.16/1.42)
## |   |   |   |   |   Population > 161: No (18.35/6.56)
## |   |   |   Price > 104
## |   |   |   |   CompPrice <= 114: No (14.73)
## |   |   |   |   CompPrice > 114
## |   |   |   |   |   Advertising <= 10
## |   |   |   |   |   |   Income <= 94: No (51.82/4.61)
## |   |   |   |   |   |   Income > 94: Yes (16.88/5.85)
## |   |   |   |   |   Advertising > 10
## |   |   |   |   |   |   CompPrice <= 135: No (16.59/6.9)
## |   |   |   |   |   |   CompPrice > 135: Yes (10.09/0.19)
## Population > 491: Yes (23.91/2.93)
##
## Number of Leaves  :   16
##
## Size of the tree :    30
##
##
## Weight: 1.65
##
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad
## |   Price <= 102
## |   |   Income <= 50: No (14.42/1.33)
## |   |   Income > 50: Yes (12.66/3.72)
## |   Price > 102: No (48.65/3.76)
## ShelveLoc = Good
## |   Price <= 135: Yes (17.08/0.24)
## |   Price > 135: No (13.85/6.08)
## ShelveLoc = Medium
## |   Population <= 210
## |   |   Advertising <= 9
## |   |   |   US = No
## |   |   |   |   Income <= 108
## |   |   |   |   |   CompPrice <= 130: No (22.18/3.42)
## |   |   |   |   |   CompPrice > 130: Yes (10.66/3.16)
## |   |   |   |   Income > 108: No (19.35/0.21)
## |   |   |   US = Yes: No (17.65/1.46)
## |   |   Advertising > 9
## |   |   |   CompPrice <= 123: No (10.03/4.26)
```

```
## |   |   |   CompPrice > 123: Yes (10.51/0.45)
## |   Population > 210
## |   |   Price <= 115: Yes (64.73/7.65)
## |   |   Price > 115
## |   |   |   CompPrice <= 142: No (28.18/8.22)
## |   |   |   CompPrice > 142: Yes (11.03/2.22)
##
## Number of Leaves  :   14
##
## Size of the tree :   26
##
##
## Weight: 1.71
##
## J48 pruned tree
## ------------------
##
## Age <= 73
## |   ShelveLoc = Bad
## |   |   Income <= 41: Yes (18.02/4.11)
## |   |   Income > 41: No (34.93/6.37)
## |   ShelveLoc = Good: Yes (32.58/3.19)
## |   ShelveLoc = Medium
## |   |   Advertising <= 10
## |   |   |   Price <= 101: Yes (56.53/11.71)
## |   |   |   Price > 101
## |   |   |   |   CompPrice <= 115: No (16.27)
## |   |   |   |   CompPrice > 115
## |   |   |   |   |   Price <= 140
## |   |   |   |   |   |   Age <= 49: Yes (19.07/4.69)
## |   |   |   |   |   |   Age > 49: No (20.47/4.24)
## |   |   |   |   |   Price > 140: No (13.27)
## |   |   Advertising > 10: Yes (45.78/8.62)
## Age > 73
## |   Advertising <= 4: No (22.57)
## |   Advertising > 4
## |   |   CompPrice <= 121: No (10.96/0.36)
## |   |   CompPrice > 121: Yes (10.55/3.02)
##
## Number of Leaves  :   12
##
## Size of the tree :    22
##
##
## Weight: 1.7
##
## J48 pruned tree
## ------------------
##
## Price <= 81: Yes (19.19/4.21)
## Price > 81
## |   CompPrice <= 135
## |   |   Price <= 134
## |   |   |   Advertising <= 0: No (76.76/13.15)
```

```
## |   |   |   Advertising > 0
## |   |   |   |   Population <= 266
## |   |   |   |   |   Price <= 102: Yes (16.79/0.1)
## |   |   |   |   |   Price > 102
## |   |   |   |   |   |   CompPrice <= 126: No (11.72/2.52)
## |   |   |   |   |   |   CompPrice > 126: Yes (11.45/1.25)
## |   |   |   |   Population > 266
## |   |   |   |   |   Price <= 111: No (34.01/3.47)
## |   |   |   |   |   Price > 111
## |   |   |   |   |   |   Price <= 119: Yes (12.14)
## |   |   |   |   |   |   Price > 119
## |   |   |   |   |   |   |   Advertising <= 18: No (19.45/1.02)
## |   |   |   |   |   |   |   Advertising > 18: Yes (10.75/3.2)
## |   |   Price > 134: No (21.09)
## |   CompPrice > 135
## |   |   Price <= 156
## |   |   |   ShelveLoc = Bad: Yes (18.84/5.14)
## |   |   |   ShelveLoc = Good: Yes (12.21/0.07)
## |   |   |   ShelveLoc = Medium
## |   |   |   |   Education <= 16: Yes (14.01/1.09)
## |   |   |   |   Education > 16: No (10.87/1.54)
## |   |   Price > 156: No (11.73/0.59)
##
## Number of Leaves  :   15
##
## Size of the tree :    28
##
##
## Weight: 1.95
##
## J48 pruned tree
## ------------------
##
## Price <= 126
## |   Income <= 45
## |   |   CompPrice <= 115: No (30.81/0.22)
## |   |   CompPrice > 115: Yes (26.08/7.35)
## |   Income > 45
## |   |   Urban = No: Yes (52.57/7.81)
## |   |   Urban = Yes
## |   |   |   Advertising <= 7
## |   |   |   |   US = No
## |   |   |   |   |   Population <= 176: No (17.78/5.77)
## |   |   |   |   |   Population > 176: Yes (20.82/2.58)
## |   |   |   |   US = Yes: No (23.77/3.68)
## |   |   |   Advertising > 7: Yes (34.62/4.61)
## Price > 126
## |   ShelveLoc = Bad: No (29.0/1.79)
## |   ShelveLoc = Good
## |   |   Income <= 62: No (10.08/4.39)
## |   |   Income > 62: Yes (10.23/1.49)
## |   ShelveLoc = Medium
## |   |   CompPrice <= 142: No (30.4/2.12)
## |   |   CompPrice > 142: Yes (14.83/6.2)
```

```
##
## Number of Leaves  :  12
##
## Size of the tree :   22
##
##
## Weight: 1.66
##
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad
## |   Advertising <= 3: Yes (27.21/10.58)
## |   Advertising > 3: No (36.78/5.96)
## ShelveLoc = Good
## |   Price <= 135: Yes (25.42/0.85)
## |   Price > 135: No (12.93/4.86)
## ShelveLoc = Medium
## |   Price <= 100
## |   |   Advertising <= 2: Yes (37.43/4.07)
## |   |   Advertising > 2: No (10.84/3.72)
## |   Price > 100
## |   |   Age <= 34
## |   |   |   Age <= 31: No (10.87/3.26)
## |   |   |   Age > 31: Yes (21.29/0.96)
## |   |   Age > 34
## |   |   |   Urban = No: No (49.58/5.35)
## |   |   |   Urban = Yes
## |   |   |   |   CompPrice <= 123: No (30.93/1.01)
## |   |   |   |   CompPrice > 123
## |   |   |   |   |   Advertising <= 8: No (24.65/3.48)
## |   |   |   |   |   Advertising > 8: Yes (13.08/2.51)
##
## Number of Leaves  :  12
##
## Size of the tree :   22
##
##
## Weight: 1.7
##
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad
## |   Income <= 97
## |   |   US = No: No (31.25/2.52)
## |   |   US = Yes
## |   |   |   Age <= 43: Yes (15.38/5.14)
## |   |   |   Age > 43: No (15.82/0.84)
## |   Income > 97: Yes (19.02/3.53)
## ShelveLoc = Good: Yes (37.76/7.52)
## ShelveLoc = Medium
## |   Income <= 24: No (11.32)
## |   Income > 24
```

```
## |   |   Price <= 120
## |   |   |   Age <= 69
## |   |   |   |   CompPrice <= 129
## |   |   |   |   |   Income <= 82
## |   |   |   |   |   |   Price <= 100: Yes (24.18/0.12)
## |   |   |   |   |   |   Price > 100
## |   |   |   |   |   |   |   Age <= 48: Yes (15.5/1.47)
## |   |   |   |   |   |   |   Age > 48: No (11.83/3.37)
## |   |   |   |   |   Income > 82
## |   |   |   |   |   |   Education <= 13: Yes (13.98/3.89)
## |   |   |   |   |   |   Education > 13: No (14.79/1.74)
## |   |   |   |   CompPrice > 129: Yes (16.95)
## |   |   |   Age > 69: No (10.95/1.49)
## |   |   Price > 120
## |   |   |   Urban = No: No (22.15/4.09)
## |   |   |   Urban = Yes
## |   |   |   |   Education <= 13: Yes (12.43/3.01)
## |   |   |   |   Education > 13
## |   |   |   |   |   Income <= 75: No (17.2/0.93)
## |   |   |   |   |   Income > 75: Yes (10.48/4.36)
##
## Number of Leaves  :   17
##
## Size of the tree :   32
##
##
## Weight: 1.76
##
## J48 pruned tree
## ------------------
##
## Price <= 126
## |   Advertising <= 5
## |   |   Population <= 263
## |   |   |   CompPrice <= 131: No (55.92/7.14)
## |   |   |   CompPrice > 131
## |   |   |   |   Education <= 12: No (10.74/1.91)
## |   |   |   |   Education > 12: Yes (14.61/1.89)
## |   |   Population > 263
## |   |   |   Urban = No: Yes (16.55/2.48)
## |   |   |   Urban = Yes
## |   |   |   |   Income <= 69: Yes (10.67/2.9)
## |   |   |   |   Income > 69: No (11.13/3.09)
## |   Advertising > 5
## |   |   Price <= 102: Yes (26.17/0.61)
## |   |   Price > 102
## |   |   |   CompPrice <= 121: No (19.68/7.58)
## |   |   |   CompPrice > 121: Yes (22.03/1.86)
## Price > 126
## |   Education <= 17
## |   |   ShelveLoc = Bad: No (28.85)
## |   |   ShelveLoc = Good
## |   |   |   Urban = No: No (10.39/0.6)
## |   |   |   Urban = Yes: Yes (20.0/6.52)
```

```
## |   |     ShelveLoc = Medium: No (34.81/3.77)
## |   Education > 17: Yes (19.46/6.04)
##
## Number of Leaves  :   14
##
## Size of the tree :    26
##
##
## Weight: 1.7
##
## J48 pruned tree
## ------------------
##
## Price <= 144
## |   Price <= 70: Yes (13.58)
## |   Price > 70
## |   |   Advertising <= 0
## |   |   |   CompPrice <= 109: No (17.23/0.03)
## |   |   |   CompPrice > 109
## |   |   |   |   ShelveLoc = Bad: No (16.32/4.25)
## |   |   |   |   ShelveLoc = Good: Yes (3.4/0.19)
## |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   Income <= 87: No (29.78/5.81)
## |   |   |   |   |   Income > 87: Yes (11.29/3.25)
## |   |   Advertising > 0
## |   |   |   CompPrice <= 117
## |   |   |   |   CompPrice <= 110
## |   |   |   |   |   Age <= 43: Yes (16.8/1.73)
## |   |   |   |   |   Age > 43: No (11.08/3.11)
## |   |   |   |   CompPrice > 110: Yes (47.42/2.6)
## |   |   |   CompPrice > 117
## |   |   |   |   US = No: Yes (18.47/3.33)
## |   |   |   |   US = Yes
## |   |   |   |   |   Price <= 125
## |   |   |   |   |   |   Income <= 70: No (17.82/6.6)
## |   |   |   |   |   |   Income > 70: Yes (10.35/0.88)
## |   |   |   |   |   Price > 125: No (33.54/5.28)
## Price > 144: No (53.91/7.08)
##
## Number of Leaves  :   14
##
## Size of the tree :    26
##
##
## Weight: 1.76
##
## J48 pruned tree
## ------------------
##
## Advertising <= 21
## |   Price <= 104
## |   |   CompPrice <= 123
## |   |   |   Advertising <= 7
## |   |   |   |   Price <= 72: Yes (12.4/1.03)
```

```
## |   |   |   |     Price > 72
## |   |   |   |   |   Price <= 96: No (13.59/0.48)
## |   |   |   |   |   Price > 96: Yes (22.91/7.13)
## |   |   |   Advertising > 7: Yes (21.48/1.74)
## |   |   CompPrice > 123: Yes (22.54)
## |   Price > 104
## |   |   Price <= 156
## |   |   |   CompPrice <= 143
## |   |   |   |   Advertising <= 3: No (47.49/5.3)
## |   |   |   |   Advertising > 3
## |   |   |   |   |   ShelveLoc = Bad: No (7.5/0.82)
## |   |   |   |   |   ShelveLoc = Good: Yes (15.25/0.68)
## |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   Price <= 135
## |   |   |   |   |   |   |   CompPrice <= 114: No (10.25)
## |   |   |   |   |   |   |   CompPrice > 114
## |   |   |   |   |   |   |   |   Age <= 44: Yes (17.12)
## |   |   |   |   |   |   |   |   Age > 44
## |   |   |   |   |   |   |   |   |   Age <= 66: No (15.23/2.53)
## |   |   |   |   |   |   |   |   |   Age > 66: Yes (14.5/1.23)
## |   |   |   |   |   |   Price > 135: No (11.98)
## |   |   |   CompPrice > 143: Yes (37.63/5.15)
## |   |   Price > 156: No (13.43)
## Advertising > 21: Yes (17.7)
##
## Number of Leaves  :  16
##
## Size of the tree :   30
##
##
## Weight: 2.35
##
## J48 pruned tree
## ------------------
##
## Advertising <= 15
## |   CompPrice <= 123
## |   |   Income <= 25: No (14.04)
## |   |   Income > 25
## |   |   |   Age <= 55
## |   |   |   |   Age <= 52
## |   |   |   |   |   Urban = No: No (10.36/1.75)
## |   |   |   |   |   Urban = Yes
## |   |   |   |   |   |   Income <= 63: No (10.28/3.39)
## |   |   |   |   |   |   Income > 63: Yes (10.7/1.12)
## |   |   |   |   Age > 52: No (23.2/0.0)
## |   |   |   Age > 55
## |   |   |   |   Age <= 58: Yes (12.23/0.45)
## |   |   |   |   Age > 58
## |   |   |   |   |   Price <= 100: Yes (16.95/4.56)
## |   |   |   |   |   Price > 100: No (31.43/3.81)
## |   CompPrice > 123
## |   |   Price <= 126: Yes (69.78/11.89)
## |   |   Price > 126
```

```
## |   |   |   ShelveLoc = Bad: No (28.85/2.14)
## |   |   |   ShelveLoc = Good: Yes (15.76/5.11)
## |   |   |   ShelveLoc = Medium: No (30.39/6.38)
## Advertising > 15: Yes (27.04/4.06)
##
## Number of Leaves  :  13
##
## Size of the tree :   24
##
##
## Weight: 1.75
##
## J48 pruned tree
## ------------------
##
## Age <= 32: Yes (36.55/7.47)
## Age > 32
## |   Income <= 114
## |   |   ShelveLoc = Bad
## |   |   |   CompPrice <= 159
## |   |   |   |   CompPrice <= 137: No (27.97/5.47)
## |   |   |   |   CompPrice > 137: Yes (15.99/3.44)
## |   |   |   CompPrice > 159: No (12.34)
## |   |   ShelveLoc = Good
## |   |   |   Price <= 135: Yes (13.33)
## |   |   |   Price > 135: No (25.6/4.25)
## |   |   ShelveLoc = Medium
## |   |   |   CompPrice <= 142
## |   |   |   |   Age <= 52
## |   |   |   |   |   Education <= 17
## |   |   |   |   |   |   Advertising <= 5: Yes (13.71/2.19)
## |   |   |   |   |   |   Advertising > 5: No (22.07/8.25)
## |   |   |   |   |   Education > 17: No (10.96/0.83)
## |   |   |   |   Age > 52
## |   |   |   |   |   Advertising <= 9: No (64.82/5.97)
## |   |   |   |   |   Advertising > 9
## |   |   |   |   |   |   Advertising <= 14: Yes (11.41/2.59)
## |   |   |   |   |   |   Advertising > 14: No (10.24/0.46)
## |   |   |   CompPrice > 142: Yes (20.8/2.71)
## |   Income > 114: Yes (15.19/1.42)
##
## Number of Leaves  :  14
##
## Size of the tree :   26
##
##
## Weight: 1.74
##
## J48 pruned tree
## ------------------
##
## Price <= 156
## |   Advertising <= 7
## |   |   Price <= 70: Yes (10.8)
```

```
## |   |   Price > 70
## |   |   |   Education <= 11
## |   |   |   |   Population <= 170: No (19.08/5.67)
## |   |   |   |   Population > 170: Yes (20.19/1.84)
## |   |   |   Education > 11
## |   |   |   |   US = No
## |   |   |   |   |   CompPrice <= 115: No (13.96/0.48)
## |   |   |   |   |   CompPrice > 115
## |   |   |   |   |   |   ShelveLoc = Bad: No (18.56/2.87)
## |   |   |   |   |   |   ShelveLoc = Good: Yes (6.16/1.41)
## |   |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   |   Population <= 279: No (19.89/5.76)
## |   |   |   |   |   |   |   Population > 279: Yes (14.58/1.88)
## |   |   |   |   US = Yes
## |   |   |   |   |   Advertising <= 3: Yes (10.44/4.34)
## |   |   |   |   |   Advertising > 3: No (43.6/4.85)
## |   Advertising > 7
## |   |   Age <= 72
## |   |   |   CompPrice <= 133
## |   |   |   |   Price <= 103: Yes (12.71)
## |   |   |   |   Price > 103
## |   |   |   |   |   CompPrice <= 113: No (12.14/1.54)
## |   |   |   |   |   CompPrice > 113
## |   |   |   |   |   |   Population <= 376: No (12.58/5.04)
## |   |   |   |   |   |   Population > 376: Yes (26.25/2.45)
## |   |   |   CompPrice > 133: Yes (30.31/1.58)
## |   |   Age > 72: No (13.63/2.15)
## Price > 156: No (16.12/1.03)
##
## Number of Leaves  :   17
##
## Size of the tree :   32
##
##
## Weight: 1.79
##
## J48 pruned tree
## ------------------
##
## Age <= 63
## |   Education <= 10: Yes (19.19/0.61)
## |   Education > 10
## |   |   Population <= 458
## |   |   |   Education <= 11: Yes (27.89/3.24)
## |   |   |   Education > 11
## |   |   |   |   Advertising <= 10
## |   |   |   |   |   US = No
## |   |   |   |   |   |   Price <= 117: Yes (26.34/4.19)
## |   |   |   |   |   |   Price > 117
## |   |   |   |   |   |   |   CompPrice <= 147: No (24.47/7.28)
## |   |   |   |   |   |   |   CompPrice > 147: Yes (10.4/2.51)
## |   |   |   |   |   US = Yes
## |   |   |   |   |   |   Income <= 50: Yes (27.88/4.69)
## |   |   |   |   |   |   Income > 50: No (18.74/2.07)
```

```
## |   |   |   |     Advertising > 10: Yes (37.04/6.55)
## |   |   Population > 458: No (28.01/6.78)
## Age > 63
## |   Income <= 45: No (16.11/0.82)
## |   Income > 45
## |   |   Income <= 64: Yes (12.45/1.16)
## |   |   Income > 64
## |   |   |   Income <= 71: No (17.67/0.0)
## |   |   |   Income > 71
## |   |   |   |   Education <= 12: No (10.12/0.65)
## |   |   |   |   Education > 12: Yes (24.69/8.63)
##
## Number of Leaves  :   14
##
## Size of the tree :    27
##
##
## Weight: 1.63
##
## J48 pruned tree
## ------------------
##
## Age <= 35
## |   Age <= 31
## |   |   Urban = No: No (13.51/1.24)
## |   |   Urban = Yes: Yes (16.37/3.72)
## |   Age > 31: Yes (43.37/5.61)
## Age > 35
## |   ShelveLoc = Bad: No (54.76/16.13)
## |   ShelveLoc = Good: Yes (37.59/7.71)
## |   ShelveLoc = Medium
## |   |   Price <= 127
## |   |   |   Advertising <= 6
## |   |   |   |   Age <= 74
## |   |   |   |   |   US = No
## |   |   |   |   |   |   CompPrice <= 124: No (15.98/3.97)
## |   |   |   |   |   |   CompPrice > 124: Yes (13.18/2.5)
## |   |   |   |   |   US = Yes: No (14.02/2.44)
## |   |   |   |   Age > 74: No (12.02)
## |   |   |   Advertising > 6
## |   |   |   |   CompPrice <= 122: No (14.45/5.89)
## |   |   |   |   CompPrice > 122: Yes (22.17/1.29)
## |   |   Price > 127: No (43.58/4.54)
##
## Number of Leaves  :   12
##
## Size of the tree :    22
##
##
## Weight: 1.5
##
## J48 pruned tree
## ------------------
##
```

```
## Price <= 102
## |   Education <= 16: Yes (65.18/9.31)
## |   Education > 16
## |   |   CompPrice <= 116: Yes (11.75/3.42)
## |   |   CompPrice > 116: No (10.38/3.01)
## Price > 102
## |   Advertising <= 21
## |   |   Price <= 156
## |   |   |   Income <= 94
## |   |   |   |   Urban = No: No (36.28/6.08)
## |   |   |   |   Urban = Yes
## |   |   |   |   |   Income <= 63
## |   |   |   |   |   |   CompPrice <= 134
## |   |   |   |   |   |   |   CompPrice <= 127
## |   |   |   |   |   |   |   |   Income <= 34: Yes (11.98/2.41)
## |   |   |   |   |   |   |   |   Income > 34: No (10.34/3.25)
## |   |   |   |   |   |   |   CompPrice > 127: No (12.9/2.03)
## |   |   |   |   |   |   CompPrice > 134: Yes (16.48/0.49)
## |   |   |   |   |   Income > 63: No (43.34/8.57)
## |   |   |   Income > 94
## |   |   |   |   Income <= 107: Yes (29.43/2.3)
## |   |   |   |   Income > 107: No (24.15/11.06)
## |   |   Price > 156: No (17.71)
## |   Advertising > 21: Yes (11.09)
##
## Number of Leaves  :  13
##
## Size of the tree :   25
##
##
## Weight: 1.57
##
## J48 pruned tree
## ------------------
##
## Advertising <= 7
## |   Age <= 76
## |   |   Income <= 25: No (11.63)
## |   |   Income > 25
## |   |   |   US = No
## |   |   |   |   Urban = No
## |   |   |   |   |   Income <= 65: No (12.59/4.65)
## |   |   |   |   |   Income > 65: Yes (17.29/0.59)
## |   |   |   |   Urban = Yes
## |   |   |   |   |   ShelveLoc = Bad: Yes (15.61/3.42)
## |   |   |   |   |   ShelveLoc = Good: Yes (10.77/2.33)
## |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   Population <= 178: No (18.81/5.69)
## |   |   |   |   |   |   Population > 178: Yes (12.81/3.13)
## |   |   |   US = Yes
## |   |   |   |   CompPrice <= 100: No (12.4)
## |   |   |   |   CompPrice > 100
## |   |   |   |   |   Education <= 16
## |   |   |   |   |   |   Education <= 13: Yes (14.77/6.42)
```

```
## |   |   |   |   |   |     Education > 13: No (14.67/0.79)
## |   |   |   |   |   |   Education > 16: Yes (11.6/1.84)
## |     Age > 76: No (12.67)
## Advertising > 7
## |     Income <= 70
## |   |     ShelveLoc = Bad: No (10.66/2.03)
## |   |     ShelveLoc = Good: Yes (13.99/3.81)
## |   |     ShelveLoc = Medium
## |   |   |   Age <= 58: Yes (29.97/6.3)
## |   |   |   Age > 58: No (13.89/3.63)
## |     Income > 70: Yes (66.89/6.75)
##
## Number of Leaves  :   17
##
## Size of the tree :    31
##
##
## Weight: 1.58
##
## J48 pruned tree
## ------------------
##
## Price <= 126
## |     Price <= 70: Yes (16.92)
## |     Price > 70
## |   |     Advertising <= 10
## |   |   |     Population <= 502
## |   |   |   |     CompPrice <= 130
## |   |   |   |   |   Urban = No: No (17.57/5.23)
## |   |   |   |   |   Urban = Yes
## |   |   |   |   |   |   Advertising <= 5: No (41.65/5.72)
## |   |   |   |   |   |   Advertising > 5: Yes (11.64/4.05)
## |   |   |   |     CompPrice > 130
## |   |   |   |   |   US = No: Yes (28.66/7.39)
## |   |   |   |   |   US = Yes: No (11.13/3.98)
## |   |   |     Population > 502: Yes (10.51/0.04)
## |   |     Advertising > 10
## |   |   |     CompPrice <= 106: No (13.99/4.31)
## |   |   |     CompPrice > 106: Yes (51.0/1.66)
## Price > 126
## |     ShelveLoc = Bad: No (15.02/1.47)
## |     ShelveLoc = Good
## |   |     Price <= 156: Yes (18.55/6.26)
## |   |     Price > 156: No (16.88)
## |     ShelveLoc = Medium: No (47.48/6.53)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
##
##
## Weight: 1.7
##
## J48 pruned tree
```

```
## ------------------
##
## Price <= 119
## |   Age <= 67
## |   |   Income <= 52
## |   |   |   CompPrice <= 112: No (11.81)
## |   |   |   CompPrice > 112: Yes (24.17/3.45)
## |   |   Income > 52: Yes (91.1/13.82)
## |   Age > 67
## |   |   Income <= 70: Yes (10.48/3.68)
## |   |   Income > 70: No (20.58/2.62)
## Price > 119
## |   CompPrice <= 146
## |   |   Price <= 134
## |   |   |   ShelveLoc = Bad: No (18.12/1.41)
## |   |   |   ShelveLoc = Good: Yes (8.95)
## |   |   |   ShelveLoc = Medium: No (36.51/10.45)
## |   |   Price > 134: No (39.81/1.59)
## |   CompPrice > 146
## |   |   Education <= 12: Yes (10.31/0.04)
## |   |   Education > 12
## |   |   |   US = No: Yes (12.5/1.15)
## |   |   |   US = Yes: No (16.66/6.2)
##
## Number of Leaves  :   12
##
## Size of the tree :    22
##
##
## Weight: 1.75
##
## J48 pruned tree
## ------------------
##
## Advertising <= 15
## |   Price <= 144
## |   |   CompPrice <= 143
## |   |   |   Price <= 81: Yes (16.28/2.15)
## |   |   |   Price > 81
## |   |   |   |   Age <= 49
## |   |   |   |   |   Income <= 62: No (19.25/4.68)
## |   |   |   |   |   Income > 62
## |   |   |   |   |   |   Population <= 112: No (10.41/2.66)
## |   |   |   |   |   |   Population > 112: Yes (35.69/1.19)
## |   |   |   |   Age > 49
## |   |   |   |   |   Age <= 55: No (34.06/1.96)
## |   |   |   |   |   Age > 55
## |   |   |   |   |   |   CompPrice <= 109: No (30.49/3.91)
## |   |   |   |   |   |   CompPrice > 109
## |   |   |   |   |   |   |   Population <= 152: No (18.68/0.91)
## |   |   |   |   |   |   |   Population > 152
## |   |   |   |   |   |   |   |   Education <= 14: Yes (25.4/2.83)
## |   |   |   |   |   |   |   |   Education > 14
## |   |   |   |   |   |   |   |   |   Age <= 69: Yes (10.1/1.66)
```

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```
## |   |   |   |   |   |   |   |   |   Age > 69: No (11.44/0.0)
## |   |   CompPrice > 143: Yes (32.03/2.21)
## |   Price > 144: No (22.3/1.65)
## Advertising > 15: Yes (34.88/5.25)
##
## Number of Leaves  :  13
##
## Size of the tree :   25
##
##
## Weight: 2.16
##
## J48 pruned tree
## ------------------
##
## Population <= 80
## |   ShelveLoc = Bad: No (2.83)
## |   ShelveLoc = Good: Yes (15.05)
## |   ShelveLoc = Medium: Yes (21.47/3.37)
## Population > 80
## |   Age <= 43
## |   |   US = No
## |   |   |   Age <= 33: Yes (10.91/2.9)
## |   |   |   Age > 33: No (14.0/3.4)
## |   |   US = Yes
## |   |   |   Income <= 80: Yes (37.71/2.83)
## |   |   |   Income > 80: No (12.42/5.07)
## |   Age > 43
## |   |   Income <= 98
## |   |   |   ShelveLoc = Bad: No (29.25/4.15)
## |   |   |   ShelveLoc = Good: Yes (21.06/8.56)
## |   |   |   ShelveLoc = Medium
## |   |   |   |   CompPrice <= 120: No (45.09/2.85)
## |   |   |   |   CompPrice > 120
## |   |   |   |   |   US = No: Yes (12.39/3.14)
## |   |   |   |   |   US = Yes
## |   |   |   |   |   |   Advertising <= 6: No (10.47)
## |   |   |   |   |   |   Advertising > 6
## |   |   |   |   |   |   |   Education <= 13: Yes (14.87/3.17)
## |   |   |   |   |   |   |   Education > 13: No (19.9/4.46)
## |   |   Income > 98
## |   |   |   CompPrice <= 116: Yes (18.78/0.17)
## |   |   |   CompPrice > 116: No (14.8/5.9)
##
## Number of Leaves  :  16
##
## Size of the tree :   29
##
##
## Weight: 1.61
##
## J48 pruned tree
## ------------------
##
```

```
## Income <= 74
## |   Age <= 60
## |   |   Income <= 29: Yes (20.02/2.05)
## |   |   Income > 29
## |   |   |   Education <= 14: No (35.06/7.82)
## |   |   |   Education > 14
## |   |   |   |   Income <= 36: No (10.45/0.54)
## |   |   |   |   Income > 36
## |   |   |   |   |   Income <= 41: Yes (14.84)
## |   |   |   |   |   Income > 41
## |   |   |   |   |   |   Advertising <= 10: No (20.59/6.69)
## |   |   |   |   |   |   Advertising > 10: Yes (13.89/2.37)
## |   Age > 60: No (63.34/5.68)
## Income > 74
## |   ShelveLoc = Bad
## |   |   Price <= 102: Yes (20.98/0.44)
## |   |   Price > 102: No (11.49/0.38)
## |   ShelveLoc = Good: Yes (30.48/0.65)
## |   ShelveLoc = Medium
## |   |   Population <= 463
## |   |   |   Population <= 391
## |   |   |   |   Age <= 33: Yes (11.47/0.67)
## |   |   |   |   Age > 33
## |   |   |   |   |   Income <= 89: Yes (11.63/2.56)
## |   |   |   |   |   Income > 89: No (10.77/1.72)
## |   |   |   Population > 391: Yes (15.79)
## |   |   Population > 463: No (10.2/1.43)
##
## Number of Leaves  :   15
##
## Size of the tree :    28
##
##
## Weight: 2.09
##
## J48 pruned tree
## ------------------
##
## Price <= 126
## |   CompPrice <= 122
## |   |   Income <= 48: No (24.14/3.85)
## |   |   Income > 48
## |   |   |   Price <= 90: Yes (33.42/1.31)
## |   |   |   Price > 90
## |   |   |   |   Price <= 96: No (11.13/0.6)
## |   |   |   |   Price > 96
## |   |   |   |   |   US = No: No (12.41/5.03)
## |   |   |   |   |   US = Yes: Yes (39.62/7.46)
## |   CompPrice > 122
## |   |   Advertising <= 10
## |   |   |   Price <= 104: Yes (28.14/0.96)
## |   |   |   Price > 104
## |   |   |   |   Price <= 122
## |   |   |   |   |   Age <= 47: Yes (10.77/1.55)
```

```
## |   |   |   |   |     Age > 47: No (13.47/4.22)
## |   |   |   |     Price > 122: Yes (15.85/1.39)
## |   |     Advertising > 10: Yes (18.36)
## Price > 126
## |     Urban = No: No (19.18/0.87)
## |     Urban = Yes
## |   |     CompPrice <= 132: No (23.23/2.56)
## |   |     CompPrice > 132
## |   |   |     Education <= 12: Yes (16.22/0.3)
## |   |   |     Education > 12
## |   |   |   |     Population <= 298: No (18.27/3.22)
## |   |   |   |     Population > 298: Yes (16.79/2.71)
##
## Number of Leaves  :   15
##
## Size of the tree :    29
##
##
## Weight: 2.0
##
## J48 pruned tree
## ------------------
##
## Population <= 491
## |   Income <= 41
## |   |   Age <= 58: Yes (61.25/8.56)
## |   |   Age > 58: No (11.56/1.8)
## |   Income > 41
## |   |   ShelveLoc = Bad
## |   |   |   Price <= 125
## |   |   |   |   Age <= 63
## |   |   |   |   |   Population <= 284: No (10.16/4.16)
## |   |   |   |   |   Population > 284: Yes (13.19/1.12)
## |   |   |   |   Age > 63: No (15.18/2.39)
## |   |   |   Price > 125: No (16.17)
## |   |   ShelveLoc = Good: Yes (19.89/4.82)
## |   |   ShelveLoc = Medium
## |   |   |   Population <= 436
## |   |   |   |   Population <= 203
## |   |   |   |   |   Education <= 12: No (19.13/1.72)
## |   |   |   |   |   Education > 12
## |   |   |   |   |   |   Price <= 117: Yes (17.71/3.38)
## |   |   |   |   |   |   Price > 117: No (11.56/0.97)
## |   |   |   |   Population > 203
## |   |   |   |   |   Income <= 94
## |   |   |   |   |   |   Population <= 256: Yes (13.31/0.56)
## |   |   |   |   |   |   Population > 256: No (19.7/8.02)
## |   |   |   |   |   Income > 94: Yes (17.79/0.17)
## |   |   |   Population > 436: No (22.06/3.48)
## Population > 491: Yes (32.32/1.56)
##
## Number of Leaves  :   15
##
## Size of the tree :    28
```

```
##
##
## Weight: 1.8
##
## J48 pruned tree
## ------------------
##
## Advertising <= 21
## |   Price <= 144
## |   |   Price <= 81: Yes (23.36/1.16)
## |   |   Price > 81
## |   |   |   CompPrice <= 99: No (15.09/0.41)
## |   |   |   CompPrice > 99
## |   |   |   |   ShelveLoc = Bad
## |   |   |   |   |   Population <= 270: Yes (25.08/3.46)
## |   |   |   |   |   Population > 270: No (35.05/7.66)
## |   |   |   |   ShelveLoc = Good: Yes (26.63/2.23)
## |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   Price <= 100: Yes (33.91/4.85)
## |   |   |   |   |   Price > 100
## |   |   |   |   |   |   CompPrice <= 123
## |   |   |   |   |   |   |   Education <= 15: No (22.03/1.43)
## |   |   |   |   |   |   |   Education > 15: Yes (10.05/4.09)
## |   |   |   |   |   |   CompPrice > 123
## |   |   |   |   |   |   |   CompPrice <= 126: Yes (18.89/0.32)
## |   |   |   |   |   |   |   CompPrice > 126
## |   |   |   |   |   |   |   |   Age <= 40: Yes (11.64/1.26)
## |   |   |   |   |   |   |   |   Age > 40: No (25.07/8.83)
## |   Price > 144: No (37.72/2.88)
## Advertising > 21: Yes (16.5)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
##
##
## Weight: 1.92
##
## J48 pruned tree
## ------------------
##
## CompPrice <= 122
## |   Population <= 213: No (50.34/6.91)
## |   Population > 213
## |   |   Income <= 100
## |   |   |   CompPrice <= 104: Yes (14.49/1.99)
## |   |   |   CompPrice > 104
## |   |   |   |   CompPrice <= 118
## |   |   |   |   |   Age <= 52: Yes (10.24/4.42)
## |   |   |   |   |   Age > 52: No (29.2/1.19)
## |   |   |   |   CompPrice > 118: Yes (19.01/7.95)
## |   |   Income > 100: Yes (13.78)
## CompPrice > 122
## |   Age <= 35
```

```
## |   |    CompPrice <= 130: No (11.57/1.74)
## |   |    CompPrice > 130: Yes (10.61/4.17)
## |   Age > 35
## |   |   Advertising <= 1
## |   |   |   Price <= 127
## |   |   |   |   CompPrice <= 133: No (13.02/4.29)
## |   |   |   |   CompPrice > 133: Yes (23.28/1.39)
## |   |   |   Price > 127: No (10.4/1.66)
## |   |   Advertising > 1: Yes (95.07/14.29)
##
## Number of Leaves  :   12
##
## Size of the tree :    23
##
##
## Weight: 1.61
##
## J48 pruned tree
## ------------------
##
## Income <= 45
## |   Price <= 135
## |   |   ShelveLoc = Bad: No (20.07/3.34)
## |   |   ShelveLoc = Good: Yes (6.64/0.31)
## |   |   ShelveLoc = Medium
## |   |   |   Price <= 108: Yes (10.96/3.38)
## |   |   |   Price > 108: No (14.27/1.55)
## |   Price > 135: No (23.43)
## Income > 45
## |   CompPrice <= 146
## |   |   Price <= 126
## |   |   |   Education <= 13
## |   |   |   |   Population <= 119: No (13.16/3.59)
## |   |   |   |   Population > 119: Yes (56.29/6.78)
## |   |   |   Education > 13
## |   |   |   |   Advertising <= 2: No (30.84/4.9)
## |   |   |   |   Advertising > 2
## |   |   |   |   |   ShelveLoc = Bad: Yes (11.05/1.06)
## |   |   |   |   |   ShelveLoc = Good: Yes (0.63)
## |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   Age <= 47: Yes (18.74/4.81)
## |   |   |   |   |   |   Age > 47: No (28.48/8.06)
## |   |   Price > 126: No (42.89/8.26)
## |   CompPrice > 146: Yes (23.56/2.4)
##
## Number of Leaves  :   14
##
## Size of the tree :    25
##
##
## Weight: 1.65
##
## J48 pruned tree
## ------------------
```

```
##
## Income <= 100
## |    Price <= 90: Yes (38.6/7.38)
## |    Price > 90
## |    |    CompPrice <= 112: No (46.36/3.48)
## |    |    CompPrice > 112
## |    |    |    Advertising <= 15
## |    |    |    |    CompPrice <= 116: Yes (29.46/5.26)
## |    |    |    |    CompPrice > 116
## |    |    |    |    |    Education <= 15
## |    |    |    |    |    |    Education <= 11
## |    |    |    |    |    |    |    US = No: Yes (10.11/3.01)
## |    |    |    |    |    |    |    US = Yes: No (15.26/6.6)
## |    |    |    |    |    |    Education > 11: No (60.85/9.96)
## |    |    |    |    |    Education > 15
## |    |    |    |    |    |    Advertising <= 4: Yes (28.61/7.9)
## |    |    |    |    |    |    Advertising > 4: No (16.12/5.25)
## |    |    |    Advertising > 15: Yes (20.21/2.69)
## Income > 100: Yes (35.41/4.2)
##
## Number of Leaves  :   10
##
## Size of the tree :    19
##
##
## Weight: 1.48
##
## J48 pruned tree
## ------------------
##
## Income <= 24: No (16.44)
## Income > 24
## |    Advertising <= 7
## |    |    ShelveLoc = Bad
## |    |    |    CompPrice <= 131: No (26.78/1.81)
## |    |    |    CompPrice > 131: Yes (21.33/9.89)
## |    |    ShelveLoc = Good
## |    |    |    Price <= 144: Yes (10.41/1.35)
## |    |    |    Price > 144: No (12.04/2.17)
## |    |    ShelveLoc = Medium
## |    |    |    Urban = No: Yes (22.7/7.81)
## |    |    |    Urban = Yes
## |    |    |    |    Income <= 78
## |    |    |    |    |    Price <= 100: Yes (15.43/0.04)
## |    |    |    |    |    Price > 100: No (17.87/3.28)
## |    |    |    |    Income > 78: No (31.32/4.49)
## |    Advertising > 7
## |    |    Price <= 102: Yes (22.94/0.17)
## |    |    Price > 102
## |    |    |    CompPrice <= 113: No (17.23/2.27)
## |    |    |    CompPrice > 113
## |    |    |    |    Income <= 46
## |    |    |    |    |    Income <= 41: Yes (11.84/2.84)
## |    |    |    |    |    Income > 41: No (10.92/0.0)
```

```
## |   |   |   |   Income > 46: Yes (63.74/11.03)
##
## Number of Leaves  :   14
##
## Size of the tree :    26
##
##
## Weight: 1.68
##
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad
## |   Education <= 16
## |   |   Price <= 101: Yes (11.44/4.19)
## |   |   Price > 101: No (64.05/1.72)
## |   Education > 16: Yes (21.46/9.79)
## ShelveLoc = Good
## |   Income <= 68: No (15.98/4.91)
## |   Income > 68: Yes (24.2/1.94)
## ShelveLoc = Medium
## |   Urban = No
## |   |   Population <= 133: No (26.31/1.3)
## |   |   Population > 133
## |   |   |   Price <= 106: Yes (10.6/1.31)
## |   |   |   Price > 106
## |   |   |   |   Income <= 63: No (12.41)
## |   |   |   |   Income > 63: Yes (12.26/4.89)
## |   Urban = Yes
## |   |   Population <= 76: Yes (21.16/1.74)
## |   |   Population > 76
## |   |   |   Population <= 202: No (21.3/3.15)
## |   |   |   Population > 202
## |   |   |   |   Education <= 12: Yes (21.6/2.23)
## |   |   |   |   Education > 12
## |   |   |   |   |   Age <= 44: Yes (10.4/1.22)
## |   |   |   |   |   Age > 44
## |   |   |   |   |   |   CompPrice <= 123: No (15.16/0.38)
## |   |   |   |   |   |   CompPrice > 123: Yes (12.67/5.02)
##
## Number of Leaves  :   15
##
## Size of the tree :    28
##
##
## Weight: 1.77
##
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad: No (101.49/17.0)
## ShelveLoc = Good
## |   Urban = No: No (16.72/7.12)
## |   Urban = Yes: Yes (26.35/3.56)
```

33

```
## ShelveLoc = Medium
## |    Price <= 104
## |    |    Income <= 26: No (10.36/1.54)
## |    |    Income > 26: Yes (40.64/8.59)
## |    Price > 104
## |    |    Urban = No: No (39.65/4.4)
## |    |    Urban = Yes
## |    |    |    Price <= 135
## |    |    |    |    CompPrice <= 123: No (23.52/3.64)
## |    |    |    |    CompPrice > 123
## |    |    |    |    |    Education <= 15: Yes (11.47/0.92)
## |    |    |    |    |    Education > 15: No (13.87/5.62)
## |    |    |    Price > 135: No (16.94/1.11)
##
## Number of Leaves  :    10
##
## Size of the tree :    18
##
##
## Weight: 1.53
##
## J48 pruned tree
## ------------------
##
## CompPrice <= 99: No (23.59/2.29)
## CompPrice > 99
## |    Price <= 144
## |    |    ShelveLoc = Bad
## |    |    |    Population <= 108: No (14.7/0.84)
## |    |    |    Population > 108
## |    |    |    |    Income <= 39: No (10.25)
## |    |    |    |    Income > 39
## |    |    |    |    |    Price <= 125: Yes (51.06/8.98)
## |    |    |    |    |    Price > 125: No (17.31/4.71)
## |    |    ShelveLoc = Good: Yes (30.3/1.1)
## |    |    ShelveLoc = Medium
## |    |    |    Age <= 60
## |    |    |    |    CompPrice <= 129
## |    |    |    |    |    Age <= 49
## |    |    |    |    |    |    US = No: No (11.85/5.15)
## |    |    |    |    |    |    US = Yes: Yes (22.17/1.85)
## |    |    |    |    |    Age > 49: No (12.41/3.07)
## |    |    |    |    CompPrice > 129: Yes (24.54/1.69)
## |    |    |    Age > 60
## |    |    |    |    Advertising <= 1: No (20.84/1.56)
## |    |    |    |    Advertising > 1
## |    |    |    |    |    Income <= 75: No (16.24/4.41)
## |    |    |    |    |    Income > 75: Yes (11.98/1.82)
## |    Price > 144: No (33.77/6.87)
##
## Number of Leaves  :    14
##
## Size of the tree :    26
##
```

```
##
## Weight: 1.76
##
## J48 pruned tree
## ------------------
##
## Age <= 73
## |   CompPrice <= 146
## |   |   ShelveLoc = Bad
## |   |   |   Advertising <= 10
## |   |   |   |   Advertising <= 2
## |   |   |   |   |   Age <= 40: No (14.86/2.54)
## |   |   |   |   |   Age > 40: Yes (11.52/2.89)
## |   |   |   |   Advertising > 2: No (14.14/0.15)
## |   |   |   Advertising > 10: Yes (13.83/3.37)
## |   |   ShelveLoc = Good: Yes (25.56/5.48)
## |   |   ShelveLoc = Medium
## |   |   |   Price <= 119
## |   |   |   |   CompPrice <= 123
## |   |   |   |   |   Education <= 16
## |   |   |   |   |   |   US = No: No (15.34/6.01)
## |   |   |   |   |   |   US = Yes
## |   |   |   |   |   |   |   CompPrice <= 111: No (11.09/2.09)
## |   |   |   |   |   |   |   CompPrice > 111: Yes (11.49/3.02)
## |   |   |   |   |   Education > 16: Yes (14.95/0.8)
## |   |   |   |   CompPrice > 123: Yes (37.3/3.27)
## |   |   |   Price > 119
## |   |   |   |   Education <= 17
## |   |   |   |   |   CompPrice <= 131: No (11.17/2.13)
## |   |   |   |   |   CompPrice > 131: Yes (17.31/7.13)
## |   |   |   |   Education > 17: No (10.5)
## |   CompPrice > 146: Yes (46.89/6.27)
## Age > 73
## |   Population <= 394: No (27.22/1.58)
## |   Population > 394: Yes (17.84/7.79)
##
## Number of Leaves  :   16
##
## Size of the tree :    30
##
##
## Weight: 1.51
##
## J48 pruned tree
## ------------------
##
## Price <= 70: Yes (20.59)
## Price > 70
## |   Population <= 491
## |   |   Advertising <= 15
## |   |   |   Price <= 156
## |   |   |   |   CompPrice <= 150
## |   |   |   |   |   ShelveLoc = Bad: No (62.74/11.31)
## |   |   |   |   |   ShelveLoc = Good
```

```
## |   |   |   |   |   |       Urban = No: No (22.0/4.06)
## |   |   |   |   |   |       Urban = Yes: Yes (15.33/1.16)
## |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   Price <= 115
## |   |   |   |   |   |   |   Price <= 111
## |   |   |   |   |   |   |   |   Price <= 104
## |   |   |   |   |   |   |   |   |   Advertising <= 6: No (19.95/7.08)
## |   |   |   |   |   |   |   |   |   Advertising > 6: Yes (12.21)
## |   |   |   |   |   |   |   |   Price > 104: No (12.3/1.03)
## |   |   |   |   |   |   |   Price > 111: Yes (13.65/0.0)
## |   |   |   |   |   |   Price > 115: No (53.16/7.59)
## |   |   |   |   CompPrice > 150: Yes (19.69/2.86)
## |   |   |   Price > 156: No (15.08)
## |   |   Advertising > 15: Yes (21.62/5.81)
## |   Population > 491: Yes (12.67/1.32)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
##
##
## Weight: 1.81
##
## J48 pruned tree
## ------------------
##
## Price <= 126
## |   Income <= 100
## |   |   Urban = No
## |   |   |   ShelveLoc = Bad: No (16.22/3.3)
## |   |   |   ShelveLoc = Good: Yes (14.55/0.64)
## |   |   |   ShelveLoc = Medium: No (20.25/7.49)
## |   |   Urban = Yes
## |   |   |   CompPrice <= 122
## |   |   |   |   CompPrice <= 116
## |   |   |   |   |   Population <= 279: Yes (27.61/4.27)
## |   |   |   |   |   Population > 279: No (11.65/3.8)
## |   |   |   |   CompPrice > 116: No (15.09/0.83)
## |   |   |   CompPrice > 122: Yes (75.97/11.41)
## |   Income > 100: Yes (27.57/0.91)
## Price > 126
## |   Education <= 17: No (77.99/15.97)
## |   Education > 17: Yes (14.09/2.35)
##
## Number of Leaves  :   10
##
## Size of the tree :    18
##
##
## Weight: 1.59
##
## J48 pruned tree
## ------------------
##
```

```
## Price <= 70: Yes (18.75)
## Price > 70
## |   Age <= 76
## |   |   ShelveLoc = Bad
## |   |   |   Age <= 38: No (16.6/0.54)
## |   |   |   Age > 38
## |   |   |   |   Age <= 43: Yes (15.8/1.16)
## |   |   |   |   Age > 43
## |   |   |   |   |   Price <= 102: Yes (14.27/4.34)
## |   |   |   |   |   Price > 102: No (16.07/1.25)
## |   |   ShelveLoc = Good: Yes (44.36/7.24)
## |   |   ShelveLoc = Medium
## |   |   |   Age <= 33: Yes (27.54/1.96)
## |   |   |   Age > 33
## |   |   |   |   Urban = No
## |   |   |   |   |   Price <= 119: Yes (26.05/2.46)
## |   |   |   |   |   Price > 119: No (10.83/3.65)
## |   |   |   |   Urban = Yes
## |   |   |   |   |   Education <= 12
## |   |   |   |   |   |   CompPrice <= 123: No (14.76/5.02)
## |   |   |   |   |   |   CompPrice > 123: Yes (19.76/0.18)
## |   |   |   |   |   Education > 12
## |   |   |   |   |   |   CompPrice <= 135: No (38.43/4.7)
## |   |   |   |   |   |   CompPrice > 135: Yes (12.24/3.86)
## |   Age > 76: No (25.54/4.38)
##
## Number of Leaves  :  14
##
## Size of the tree :   26
##
##
## Weight: 1.85
##
## J48 pruned tree
## ------------------
##
## Income <= 45
## |   CompPrice <= 113: No (25.49/0.16)
## |   CompPrice > 113
## |   |   Price <= 135
## |   |   |   US = No: No (14.48/5.83)
## |   |   |   US = Yes: Yes (15.17/3.2)
## |   |   Price > 135: No (13.97)
## Income > 45
## |   Price <= 86: Yes (29.99)
## |   Price > 86
## |   |   Education <= 11: Yes (45.38/6.27)
## |   |   Education > 11
## |   |   |   Age <= 51
## |   |   |   |   Advertising <= 10
## |   |   |   |   |   US = No
## |   |   |   |   |   |   Education <= 16: Yes (11.19/3.77)
## |   |   |   |   |   |   Education > 16: No (16.97/0.81)
## |   |   |   |   |   US = Yes: No (27.11/0.1)
```

```
## |   |   |   |     Advertising > 10: Yes (18.22/6.36)
## |   |   |   Age > 51
## |   |   |   |   CompPrice <= 145
## |   |   |   |   |   ShelveLoc = Bad: No (15.39/3.11)
## |   |   |   |   |   ShelveLoc = Good: Yes (11.07/1.44)
## |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   Price <= 101: Yes (20.0/3.2)
## |   |   |   |   |   |   Price > 101: No (12.7/3.3)
## |   |   |   |   CompPrice > 145: Yes (23.86/0.68)
##
## Number of Leaves  :  15
##
## Size of the tree :   28
##
##
## Weight: 1.93
##
## J48 pruned tree
## ------------------
##
## Price <= 102
## |   CompPrice <= 100: No (20.27/4.25)
## |   CompPrice > 100
## |   |   CompPrice <= 124
## |   |   |   Advertising <= 0: No (19.81/8.03)
## |   |   |   Advertising > 0: Yes (46.5/4.46)
## |   |   CompPrice > 124: Yes (16.89)
## Price > 102
## |   Age <= 55
## |   |   Age <= 32
## |   |   |   Income <= 60: No (16.98/1.9)
## |   |   |   Income > 60: Yes (11.95/1.44)
## |   |   Age > 32: No (95.32/14.07)
## |   Age > 55
## |   |   Education <= 12
## |   |   |   Population <= 256: Yes (10.63/4.16)
## |   |   |   Population > 256: No (15.08/0.03)
## |   |   Education > 12
## |   |   |   Population <= 396: No (19.8/8.67)
## |   |   |   Population > 396: Yes (27.77/2.35)
##
## Number of Leaves  :  11
##
## Size of the tree :   21
##
##
## Weight: 1.63
##
## J48 pruned tree
## ------------------
##
## Price <= 123
## |   Price <= 70: Yes (17.12)
## |   Price > 70
```

```
## |   |     ShelveLoc = Bad
## |   |   |   Income <= 97
## |   |   |   |   CompPrice <= 122: No (17.69/0.26)
## |   |   |   |   CompPrice > 122: Yes (20.8/5.51)
## |   |   |   Income > 97: Yes (13.95/0.74)
## |   |     ShelveLoc = Good: Yes (22.01/2.39)
## |   |     ShelveLoc = Medium
## |   |   |   Population <= 466
## |   |   |   |   Population <= 435
## |   |   |   |   |   Price <= 115
## |   |   |   |   |   |   Price <= 96: No (10.79/3.21)
## |   |   |   |   |   |   Price > 96: Yes (36.83/7.21)
## |   |   |   |   |   Price > 115: No (12.13/1.99)
## |   |   |   |   Population > 435: No (10.58/0.08)
## |   |   |   Population > 466: Yes (28.24/0.65)
## Price > 123
## |   Advertising <= 22
## |   |   CompPrice <= 146: No (73.14/16.82)
## |   |   CompPrice > 146
## |   |   |   Income <= 82: No (14.71/6.05)
## |   |   |   Income > 82: Yes (11.57/0.62)
## |   Advertising > 22: Yes (11.46)
##
## Number of Leaves  :  14
##
## Size of the tree :   26
##
##
## Weight: 1.72
##
## J48 pruned tree
## ------------------
##
## Population <= 13: No (17.55)
## Population > 13
## |   ShelveLoc = Bad
## |   |   Education <= 17
## |   |   |   CompPrice <= 137
## |   |   |   |   Price <= 102
## |   |   |   |   |   Education <= 16: Yes (11.46/1.68)
## |   |   |   |   |   Education > 16: No (11.13/2.94)
## |   |   |   |   Price > 102: No (16.33/0.53)
## |   |   |   CompPrice > 137: Yes (12.81/1.7)
## |   |   Education > 17: Yes (17.07/0.0)
## |   ShelveLoc = Good
## |   |   Population <= 236: No (17.11/3.11)
## |   |   Population > 236: Yes (55.44/3.99)
## |   ShelveLoc = Medium
## |   |   Age <= 38: Yes (31.19/4.77)
## |   |   Age > 38
## |   |   |   Age <= 64
## |   |   |   |   US = No
## |   |   |   |   |   Income <= 63: No (10.4/0.96)
## |   |   |   |   |   Income > 63: Yes (15.44/4.2)
```

```
## |   |   |   |   US = Yes
## |   |   |   |   |   Education <= 12: Yes (21.05/8.91)
## |   |   |   |   |   Education > 12: No (28.02/6.14)
## |   |   |   Age > 64: Yes (36.01/9.62)
##
## Number of Leaves  :  14
##
## Size of the tree :   26
##
##
## Weight: 1.65
##
## J48 pruned tree
## ------------------
##
## Age <= 74
## |   ShelveLoc = Bad
## |   |   Education <= 16
## |   |   |   Population <= 372: No (24.0/3.22)
## |   |   |   Population > 372: Yes (10.37/2.8)
## |   |   Education > 16: Yes (24.43/3.42)
## |   ShelveLoc = Good
## |   |   CompPrice <= 114: No (13.0/5.46)
## |   |   CompPrice > 114: Yes (36.65/1.83)
## |   ShelveLoc = Medium
## |   |   Income <= 89
## |   |   |   Income <= 70
## |   |   |   |   Income <= 67
## |   |   |   |   |   Education <= 14: No (41.77/11.1)
## |   |   |   |   |   Education > 14: Yes (35.58/8.64)
## |   |   |   |   Income > 67: No (16.02/0.15)
## |   |   |   Income > 70: Yes (23.36/4.25)
## |   |   Income > 89: No (38.0/6.12)
## Age > 74: No (37.84/5.68)
##
## Number of Leaves  :  11
##
## Size of the tree :   20
##
##
## Weight: 1.55
##
## J48 pruned tree
## ------------------
##
## Advertising <= 7
## |   Age <= 76
## |   |   Price <= 154
## |   |   |   Age <= 29: No (16.19/1.4)
## |   |   |   Age > 29
## |   |   |   |   CompPrice <= 139
## |   |   |   |   |   ShelveLoc = Bad: No (25.98/6.16)
## |   |   |   |   |   ShelveLoc = Good: Yes (9.79/0.62)
## |   |   |   |   |   ShelveLoc = Medium
```

```
## |   |   |   |   |   |         Advertising <= 4
## |   |   |   |   |   |   |       Population <= 198
## |   |   |   |   |   |   |   |     Income <= 95: No (25.61/1.97)
## |   |   |   |   |   |   |   |     Income > 95: Yes (10.25/3.8)
## |   |   |   |   |   |   |       Population > 198: Yes (28.03/4.52)
## |   |   |   |   |   |       Advertising > 4: No (12.76/1.37)
## |   |   |   |     CompPrice > 139: Yes (25.64/2.66)
## |   |     Price > 154: No (12.46)
## |     Age > 76: No (13.6)
## Advertising > 7
## |     Advertising <= 21
## |   |     Advertising <= 17
## |   |   |     Education <= 16: Yes (74.94/13.97)
## |   |   |     Education > 16: No (19.45/8.95)
## |   |     Advertising > 17: No (13.89/1.65)
## |     Advertising > 21: Yes (12.4)
##
## Number of Leaves  :   14
##
## Size of the tree :   26
##
##
## Weight: 1.69
##
## J48 pruned tree
## ------------------
##
## Price <= 102
## |     Advertising <= 7
## |   |     CompPrice <= 124
## |   |   |     Price <= 70: Yes (12.29)
## |   |   |     Price > 70
## |   |   |   |     Education <= 15
## |   |   |   |   |     Urban = No: Yes (11.58/0.93)
## |   |   |   |   |     Urban = Yes: No (21.07/6.75)
## |   |   |   |     Education > 15: No (11.08/0.3)
## |   |     CompPrice > 124: Yes (14.6)
## |     Advertising > 7: Yes (32.57/0.47)
## Price > 102
## |     ShelveLoc = Bad: No (44.51/8.69)
## |     ShelveLoc = Good
## |   |     Price <= 135: Yes (17.8/1.69)
## |   |     Price > 135: No (17.89/3.75)
## |     ShelveLoc = Medium
## |   |     CompPrice <= 114: No (18.54/0.44)
## |   |     CompPrice > 114
## |   |   |     Advertising <= 10
## |   |   |   |     Education <= 10: No (16.16/0.55)
## |   |   |   |     Education > 10
## |   |   |   |   |     US = No
## |   |   |   |   |   |     Age <= 48: No (14.72/3.44)
## |   |   |   |   |   |     Age > 48: Yes (14.49/4.42)
## |   |   |   |   |     US = Yes
## |   |   |   |   |   |     Income <= 39: Yes (10.25/4.55)
```

```
## |   |   |   |   |   |    Income > 39: No (11.65)
## |   |   |     Advertising > 10
## |   |   |   |   CompPrice <= 123: No (11.04/4.78)
## |   |   |   |   CompPrice > 123: Yes (20.76/1.94)
##
## Number of Leaves  :  17
##
## Size of the tree :   32
##
##
## Weight: 1.8
##
## J48 pruned tree
## ------------------
##
## Urban = No
## |    Income <= 48: No (43.66/2.7)
## |    Income > 48
## |   |   CompPrice <= 128: Yes (38.54/4.3)
## |   |   CompPrice > 128: No (28.42/5.76)
## Urban = Yes
## |    Age <= 43: Yes (80.97/12.31)
## |    Age > 43
## |   |   ShelveLoc = Bad
## |   |   |    Education <= 14: No (12.49/4.35)
## |   |   |    Education > 14: Yes (17.66/1.86)
## |   |   ShelveLoc = Good: Yes (14.83/2.95)
## |   |   ShelveLoc = Medium
## |   |   |    Price <= 100: Yes (24.32/7.5)
## |   |   |    Price > 100
## |   |   |   |    Education <= 16
## |   |   |   |   |    CompPrice <= 123: No (13.95/0.48)
## |   |   |   |   |    CompPrice > 123: Yes (12.72/2.76)
## |   |   |   |    Education > 16: No (13.43/0.62)
##
## Number of Leaves  :  11
##
## Size of the tree :   20
##
##
## Weight: 1.72
##
## J48 pruned tree
## ------------------
##
## Price <= 144
## |    Age <= 63
## |   |    Age <= 55
## |   |   |    Age <= 54
## |   |   |   |    CompPrice <= 114: No (25.62/6.47)
## |   |   |   |    CompPrice > 114
## |   |   |   |   |    Income <= 96
## |   |   |   |   |   |    Price <= 104: Yes (18.31/1.21)
## |   |   |   |   |   |    Price > 104
```

```
## |   |   |   |   |   |   |         Advertising <= 2: No (16.24/0.29)
## |   |   |   |   |   |   |         Advertising > 2
## |   |   |   |   |   |   |   |   Population <= 276: Yes (23.06/0.4)
## |   |   |   |   |   |   |   |   Population > 276
## |   |   |   |   |   |   |   |   |   Population <= 376: No (18.53/0.41)
## |   |   |   |   |   |   |   |   |   Population > 376: Yes (10.11/2.46)
## |   |   |   |   |   Income > 96: Yes (18.51)
## |   |   |   Age > 54: No (16.27/2.06)
## |   |   Age > 55: Yes (45.52/6.13)
## |   Age > 63
## |   |   Education <= 16: No (45.25/7.16)
## |   |   Education > 16: Yes (13.46/4.99)
## Price > 144: No (50.13/8.48)
##
## Number of Leaves  :   12
##
## Size of the tree :    23
##
##
## Weight: 1.87
##
## J48 pruned tree
## ------------------
##
## Income <= 92
## |   Price <= 88: Yes (21.82/3.33)
## |   Price > 88
## |   |   Income <= 81
## |   |   |   CompPrice <= 112: No (24.25/2.48)
## |   |   |   CompPrice > 112
## |   |   |   |   Income <= 75
## |   |   |   |   |   Income <= 67
## |   |   |   |   |   |   Price <= 104: Yes (24.7/3.66)
## |   |   |   |   |   |   Price > 104
## |   |   |   |   |   |   |   Income <= 45: No (43.63/9.27)
## |   |   |   |   |   |   |   Income > 45
## |   |   |   |   |   |   |   |   Age <= 51: No (11.14/3.39)
## |   |   |   |   |   |   |   |   Age > 51: Yes (19.07/0.34)
## |   |   |   |   |   Income > 67: No (28.51/4.55)
## |   |   |   |   Income > 75: Yes (12.15/0.85)
## |   |   Income > 81: No (19.61/1.2)
## Income > 92
## |   ShelveLoc = Bad: Yes (16.75/2.44)
## |   ShelveLoc = Good: Yes (34.23/2.2)
## |   ShelveLoc = Medium
## |   |   Urban = No: Yes (22.6/3.61)
## |   |   Urban = Yes: No (22.54/3.26)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
##
##
## Weight: 1.86
```

```
## 
## J48 pruned tree
## ------------------
## 
## Urban = No
## |   Population <= 133: No (27.3/1.77)
## |   Population > 133
## |   |   Income <= 48: No (23.35/2.37)
## |   |   Income > 48: Yes (34.52/7.1)
## Urban = Yes
## |   CompPrice <= 131
## |   |   Advertising <= 5: No (57.55/15.86)
## |   |   Advertising > 5: Yes (55.69/16.4)
## |   CompPrice > 131: Yes (102.59/21.74)
## 
## Number of Leaves  :  6
## 
## Size of the tree :   11
## 
## 
## Weight: 1.28
## 
## J48 pruned tree
## ------------------
## 
## ShelveLoc = Bad
## |   Population <= 279
## |   |   CompPrice <= 131: No (21.27/2.64)
## |   |   CompPrice > 131: Yes (23.69/4.01)
## |   Population > 279: No (42.03/5.85)
## ShelveLoc = Good
## |   Price <= 150: Yes (29.43/2.05)
## |   Price > 150: No (15.67/5.54)
## ShelveLoc = Medium
## |   Price <= 86: Yes (14.15)
## |   Price > 86
## |   |   Age <= 35: Yes (31.44/5.63)
## |   |   Age > 35
## |   |   |   CompPrice <= 100: No (12.41)
## |   |   |   CompPrice > 100
## |   |   |   |   Price <= 100: Yes (22.95/6.67)
## |   |   |   |   Price > 100
## |   |   |   |   |   Income <= 66
## |   |   |   |   |   |   CompPrice <= 124: No (13.38/0.46)
## |   |   |   |   |   |   CompPrice > 124
## |   |   |   |   |   |   |   Price <= 119: Yes (11.65/1.11)
## |   |   |   |   |   |   |   Price > 119: No (16.09/7.48)
## |   |   |   |   |   Income > 66: No (46.85/4.52)
## 
## Number of Leaves  :  13
## 
## Size of the tree :   24
## 
## 
```

```
## Weight: 1.71
##
## J48 pruned tree
## ------------------
##
## Price <= 70: Yes (15.22)
## Price > 70
## |   Advertising <= 0
## |   |   CompPrice <= 143: No (83.91/14.92)
## |   |   CompPrice > 143: Yes (18.78/3.24)
## |   Advertising > 0
## |   |   Advertising <= 21
## |   |   |   US = No: Yes (18.89/3.42)
## |   |   |   US = Yes
## |   |   |   |   Urban = No
## |   |   |   |   |   Price <= 132
## |   |   |   |   |   |   Income <= 73: No (10.28/4.3)
## |   |   |   |   |   |   Income > 73: Yes (10.68/4.15)
## |   |   |   |   |   Price > 132: No (11.19)
## |   |   |   |   Urban = Yes
## |   |   |   |   |   ShelveLoc = Bad
## |   |   |   |   |   |   Population <= 279: Yes (26.13/6.21)
## |   |   |   |   |   |   Population > 279: No (16.91/2.29)
## |   |   |   |   |   ShelveLoc = Good: Yes (16.02/2.01)
## |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   Age <= 40: Yes (18.23/0.0)
## |   |   |   |   |   |   Age > 40
## |   |   |   |   |   |   |   Education <= 11: Yes (10.59/2.59)
## |   |   |   |   |   |   |   Education > 11: No (30.02/5.31)
## |   |   Advertising > 21: Yes (14.16)
##
## Number of Leaves  :   14
##
## Size of the tree :    26
##
##
## Weight: 1.65
##
## J48 pruned tree
## ------------------
##
## Price <= 156
## |   ShelveLoc = Bad
## |   |   Population <= 449
## |   |   |   Population <= 95: No (14.42)
## |   |   |   Population > 95
## |   |   |   |   CompPrice <= 103: No (10.99)
## |   |   |   |   CompPrice > 103
## |   |   |   |   |   Price <= 125: Yes (21.95/7.6)
## |   |   |   |   |   Price > 125: No (16.01/2.44)
## |   |   Population > 449: Yes (16.16/1.02)
## |   ShelveLoc = Good: Yes (42.92/5.83)
## |   ShelveLoc = Medium
## |   |   CompPrice <= 97: No (15.5/1.28)
```

```
## |    |    CompPrice > 97
## |    |    |    Price <= 127
## |    |    |    |    Advertising <= 6
## |    |    |    |    |    Age <= 50: Yes (25.86/3.11)
## |    |    |    |    |    Age > 50
## |    |    |    |    |    |    Age <= 74
## |    |    |    |    |    |    |    Income <= 41: No (10.59/1.0)
## |    |    |    |    |    |    |    Income > 41
## |    |    |    |    |    |    |    |    Price <= 97: No (13.7/5.84)
## |    |    |    |    |    |    |    |    Price > 97: Yes (10.64/1.28)
## |    |    |    |    |    |    Age > 74: No (10.26)
## |    |    |    |    Advertising > 6: Yes (43.01/4.86)
## |    |    |    Price > 127: No (28.45/8.61)
## Price > 156: No (20.53/3.03)
##
## Number of Leaves  :   15
##
## Size of the tree :    28
##
##
## Weight: 1.72
##
## J48 pruned tree
## ------------------
##
## Advertising <= 21
## |    Age <= 76
## |    |    Price <= 102
## |    |    |    Income <= 46: No (19.76/6.25)
## |    |    |    Income > 46: Yes (52.25/8.07)
## |    |    Price > 102
## |    |    |    CompPrice <= 130: No (95.05/20.65)
## |    |    |    CompPrice > 130
## |    |    |    |    Price <= 144: Yes (62.92/13.95)
## |    |    |    |    Price > 144: No (22.22/7.13)
## |    Age > 76: No (26.0/3.58)
## Advertising > 21: Yes (22.8)
##
## Number of Leaves  :   7
##
## Size of the tree :    13
##
##
## Weight: 1.4
##
## J48 pruned tree
## ------------------
##
## Advertising <= 15
## |    ShelveLoc = Bad
## |    |    US = No: No (38.28/4.51)
## |    |    US = Yes
## |    |    |    Income <= 81: Yes (15.94/5.95)
## |    |    |    Income > 81: No (14.26/1.51)
```

```
## |     ShelveLoc = Good
## |     |     Age <= 42: No (10.59/3.38)
## |     |     Age > 42: Yes (55.03/8.02)
## |     ShelveLoc = Medium
## |     |     Price <= 115
## |     |     |     CompPrice <= 122
## |     |     |     |     Age <= 52: Yes (10.96/0.17)
## |     |     |     |     Age > 52
## |     |     |     |     |     Urban = No: Yes (10.11/2.7)
## |     |     |     |     |     Urban = Yes: No (26.99/6.73)
## |     |     |     CompPrice > 122: Yes (27.23/1.94)
## |     |     Price > 115
## |     |     |     CompPrice <= 127: No (15.94)
## |     |     |     CompPrice > 127
## |     |     |     |     Advertising <= 2: No (21.3/5.04)
## |     |     |     |     Advertising > 2: Yes (20.25/5.13)
## Advertising > 15: Yes (34.13/3.69)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
##
##
## Weight: 1.64
##
## J48 pruned tree
## ------------------
##
## Price <= 70: Yes (18.22)
## Price > 70
## |     Income <= 92
## |     |     Price <= 135
## |     |     |     ShelveLoc = Bad
## |     |     |     |     CompPrice <= 122: No (21.03/0.03)
## |     |     |     |     CompPrice > 122
## |     |     |     |     |     Education <= 14: No (13.34/1.09)
## |     |     |     |     |     Education > 14: Yes (15.45/6.57)
## |     |     |     ShelveLoc = Good: Yes (24.16/1.78)
## |     |     |     ShelveLoc = Medium
## |     |     |     |     Urban = No: No (26.15/7.2)
## |     |     |     |     Urban = Yes
## |     |     |     |     |     Age <= 60: Yes (23.41/3.76)
## |     |     |     |     |     Age > 60
## |     |     |     |     |     |     Age <= 67: No (14.46/1.84)
## |     |     |     |     |     |     Age > 67: Yes (18.77/6.91)
## |     |     Price > 135: No (48.59/6.78)
## |     Income > 92
## |     |     US = No: Yes (38.15/6.12)
## |     |     US = Yes
## |     |     |     Income <= 100: No (16.62/4.79)
## |     |     |     Income > 100: Yes (22.66/4.98)
##
## Number of Leaves  :   13
##
```

```
## Size of the tree :    24
##
##
## Weight: 1.57
##
## J48 pruned tree
## ------------------
##
## Advertising <= 21
## |   Price <= 104
## |   |   CompPrice <= 123
## |   |   |   Age <= 35: Yes (13.84)
## |   |   |   Age > 35
## |   |   |   |   Income <= 93
## |   |   |   |   |   ShelveLoc = Bad: No (15.73/1.35)
## |   |   |   |   |   ShelveLoc = Good: Yes (3.08)
## |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   Population <= 71: Yes (14.78/4.23)
## |   |   |   |   |   |   Population > 71: No (22.24/5.55)
## |   |   |   |   Income > 93: Yes (18.29/2.55)
## |   |   CompPrice > 123: Yes (19.58)
## |   Price > 104
## |   |   Income <= 107
## |   |   |   Income <= 92: No (110.29/25.28)
## |   |   |   Income > 92
## |   |   |   |   CompPrice <= 129: No (11.98/4.07)
## |   |   |   |   CompPrice > 129: Yes (24.09/2.14)
## |   |   Income > 107: No (26.77/0.73)
## Advertising > 21: Yes (20.33)
##
## Number of Leaves  :   12
##
## Size of the tree :    22
##
##
## Weight: 1.72
##
## J48 pruned tree
## ------------------
##
## Population <= 468
## |   Age <= 73
## |   |   Population <= 449
## |   |   |   Income <= 111
## |   |   |   |   CompPrice <= 99: No (11.62/2.28)
## |   |   |   |   CompPrice > 99
## |   |   |   |   |   ShelveLoc = Bad
## |   |   |   |   |   |   Population <= 286: Yes (23.2/6.97)
## |   |   |   |   |   |   Population > 286: No (15.28/3.22)
## |   |   |   |   |   ShelveLoc = Good: Yes (39.86/2.35)
## |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   Advertising <= 0
## |   |   |   |   |   |   |   CompPrice <= 126: No (22.52/1.84)
## |   |   |   |   |   |   |   CompPrice > 126: Yes (10.79/2.99)
```

```
## |   |   |   |   |   |         Advertising > 0
## |   |   |   |   |   |   |     Price <= 103: Yes (20.83)
## |   |   |   |   |   |   |     Price > 103
## |   |   |   |   |   |   |   |    CompPrice <= 142
## |   |   |   |   |   |   |   |   |    Age <= 38: Yes (13.72/0.9)
## |   |   |   |   |   |   |   |   |    Age > 38
## |   |   |   |   |   |   |   |   |   |    Population <= 206: Yes (14.45/3.54)
## |   |   |   |   |   |   |   |   |   |    Population > 206: No (10.18/1.43)
## |   |   |   |   |   |   |   |    CompPrice > 142: Yes (19.07/0.2)
## |   |   |    Income > 111: No (15.53/3.37)
## |   |    Population > 449: No (11.45/1.14)
## |    Age > 73: No (28.95/5.55)
## Population > 468: Yes (43.56/4.11)
##
## Number of Leaves  :   15
##
## Size of the tree :    28
##
##
## Weight: 1.88
##
## J48 pruned tree
## ------------------
##
## Price <= 88: Yes (40.37/3.5)
## Price > 88
## |    Population <= 178
## |   |    US = No: No (44.52/5.86)
## |   |    US = Yes
## |   |   |    Price <= 130
## |   |   |   |    CompPrice <= 123: No (14.19/3.33)
## |   |   |   |    CompPrice > 123: Yes (11.41/1.2)
## |   |   |    Price > 130: No (16.3/0.0)
## |    Population > 178
## |   |    Income <= 48
## |   |   |    Price <= 135
## |   |   |   |    Price <= 118: No (12.42/2.49)
## |   |   |   |    Price > 118: Yes (19.91/4.36)
## |   |   |    Price > 135: No (20.77)
## |   |    Income > 48
## |   |   |    Urban = No: Yes (39.61/5.01)
## |   |   |    Urban = Yes
## |   |   |   |    Price <= 98: No (10.23/2.32)
## |   |   |   |    Price > 98
## |   |   |   |   |    Price <= 127: Yes (38.03/2.66)
## |   |   |   |   |    Price > 127
## |   |   |   |   |   |    ShelveLoc = Bad: No (5.37)
## |   |   |   |   |   |    ShelveLoc = Good: Yes (10.05/2.3)
## |   |   |   |   |   |    ShelveLoc = Medium: Yes (17.82/6.36)
##
## Number of Leaves  :   14
##
## Size of the tree :    26
##
```

```
##
## Weight: 1.89
##
## J48 pruned tree
## ------------------
##
## Price <= 107
## |   CompPrice <= 121
## |   |   Income <= 48: No (22.09/2.2)
## |   |   Income > 48: Yes (45.96/10.64)
## |   CompPrice > 121: Yes (31.93/0.96)
## Price > 107
## |   CompPrice <= 146
## |   |   Price <= 128
## |   |   |   Education <= 12: No (35.77/4.93)
## |   |   |   Education > 12
## |   |   |   |   Education <= 13: Yes (17.74/0.46)
## |   |   |   |   Education > 13
## |   |   |   |   |   Price <= 112: No (18.39/0.13)
## |   |   |   |   |   Price > 112
## |   |   |   |   |   |   Education <= 16: Yes (23.27/5.77)
## |   |   |   |   |   |   Education > 16: No (16.55/4.86)
## |   |   Price > 128: No (58.2/3.87)
## |   CompPrice > 146: Yes (31.1/7.31)
##
## Number of Leaves  :   10
##
## Size of the tree :    19
##
##
## Weight: 1.84
##
## J48 pruned tree
## ------------------
##
## Advertising <= 18
## |   ShelveLoc = Bad
## |   |   Age <= 40: No (33.84/2.12)
## |   |   Age > 40
## |   |   |   Population <= 192: No (14.8/0.85)
## |   |   |   Population > 192
## |   |   |   |   CompPrice <= 122: No (14.46/2.16)
## |   |   |   |   CompPrice > 122: Yes (17.11/2.64)
## |   ShelveLoc = Good
## |   |   Price <= 133: Yes (21.47/0.59)
## |   |   Price > 133: No (19.37/7.43)
## |   ShelveLoc = Medium
## |   |   Price <= 144
## |   |   |   Age <= 33: Yes (24.3/4.35)
## |   |   |   Age > 33
## |   |   |   |   Price <= 90: Yes (11.57/1.45)
## |   |   |   |   Price > 90
## |   |   |   |   |   Age <= 55: No (48.35/8.42)
## |   |   |   |   |   Age > 55
```

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```
## |   |   |   |   |   |     Advertising <= 8: No (31.21/9.27)
## |   |   |   |   |   |     Advertising > 8: Yes (24.98/6.33)
## |   |     Price > 144: No (20.81)
## Advertising > 18: Yes (18.74/2.25)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
##
##
## Weight: 1.67
##
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad
## |   Population <= 402
## |   |   Population <= 286
## |   |   |   CompPrice <= 131
## |   |   |   |   Advertising <= 7: No (14.71)
## |   |   |   |   Advertising > 7: Yes (10.27/3.83)
## |   |   |   CompPrice > 131: Yes (11.97/2.22)
## |   |   Population > 286: No (20.94/1.64)
## |   Population > 402: Yes (14.34/2.96)
## ShelveLoc = Good: Yes (44.73/8.94)
## ShelveLoc = Medium
## |   Population <= 492
## |   |   Population <= 449
## |   |   |   Price <= 115: Yes (62.83/18.04)
## |   |   |   Price > 115
## |   |   |   |   CompPrice <= 125: No (25.97/0.91)
## |   |   |   |   CompPrice > 125
## |   |   |   |   |   Education <= 13: Yes (21.19/5.17)
## |   |   |   |   |   Education > 13
## |   |   |   |   |   |   Population <= 310: No (21.25/3.48)
## |   |   |   |   |   |   Population > 310: Yes (12.84/3.85)
## |   |   Population > 449: No (24.08/1.22)
## |   Population > 492: Yes (15.88/1.4)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
##
##
## Weight: 1.53
##
## J48 pruned tree
## ------------------
##
## Education <= 17
## |   Income <= 95
## |   |   CompPrice <= 111: No (51.94/3.62)
## |   |   CompPrice > 111
## |   |   |   Advertising <= 0: No (82.73/17.81)
```

```
## |   |   |     Advertising > 0
## |   |   |   |   Price <= 102: Yes (12.18)
## |   |   |   |   Price > 102
## |   |   |   |   |   US = No: Yes (10.27/3.67)
## |   |   |   |   |   US = Yes
## |   |   |   |   |   |   Advertising <= 15
## |   |   |   |   |   |   |   Income <= 30: Yes (10.08/3.43)
## |   |   |   |   |   |   |   Income > 30: No (49.8/7.57)
## |   |   |   |   |   |   Advertising > 15: Yes (13.79/4.17)
## |   Income > 95
## |   |   US = No: Yes (23.51/3.74)
## |   |   US = Yes
## |   |   |   ShelveLoc = Bad: No (10.08/4.05)
## |   |   |   ShelveLoc = Good: Yes (5.99/1.22)
## |   |   |   ShelveLoc = Medium: No (12.92/3.96)
## Education > 17: Yes (17.71/4.14)
##
## Number of Leaves  :   12
##
## Size of the tree :    22
##
##
## Weight: 1.45
##
## J48 pruned tree
## ------------------
##
## Income <= 25: No (15.34/0.62)
## Income > 25
## |   Age <= 73
## |   |   ShelveLoc = Bad
## |   |   |   Price <= 102: Yes (23.22/3.77)
## |   |   |   Price > 102: No (30.18/9.97)
## |   |   ShelveLoc = Good
## |   |   |   Urban = No: No (12.94/5.09)
## |   |   |   Urban = Yes: Yes (33.91/2.02)
## |   |   ShelveLoc = Medium
## |   |   |   Urban = No
## |   |   |   |   Price <= 119: Yes (23.52/2.66)
## |   |   |   |   Price > 119: No (11.61/1.27)
## |   |   |   Urban = Yes
## |   |   |   |   CompPrice <= 125
## |   |   |   |   |   CompPrice <= 116
## |   |   |   |   |   |   Advertising <= 0: No (20.71/2.63)
## |   |   |   |   |   |   Advertising > 0: Yes (16.73/6.82)
## |   |   |   |   |   CompPrice > 116: No (21.98/0.96)
## |   |   |   |   CompPrice > 125
## |   |   |   |   |   Price <= 127: Yes (27.01/0.94)
## |   |   |   |   |   Price > 127: No (23.49/5.44)
## |   Age > 73: No (40.38/8.14)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
```

```
##
##
## Weight: 1.61
##
## J48 pruned tree
## ------------------
##
## CompPrice <= 121
## |   Price <= 70: Yes (11.02)
## |   Price > 70
## |   |   Urban = No
## |   |   |   Education <= 11: Yes (14.28/0.99)
## |   |   |   Education > 11: No (19.37/8.99)
## |   |   Urban = Yes
## |   |   |   ShelveLoc = Bad: No (16.15/2.95)
## |   |   |   ShelveLoc = Good: Yes (9.64/3.14)
## |   |   |   ShelveLoc = Medium: No (54.53/5.81)
## CompPrice > 121
## |   Price <= 156
## |   |   Urban = No
## |   |   |   Income <= 75: No (24.97/5.75)
## |   |   |   Income > 75: Yes (13.08/2.5)
## |   |   Urban = Yes
## |   |   |   CompPrice <= 142
## |   |   |   |   Advertising <= 7
## |   |   |   |   |   Price <= 102: Yes (10.1/1.35)
## |   |   |   |   |   Price > 102: No (18.73/4.17)
## |   |   |   |   Advertising > 7: Yes (53.58/6.42)
## |   |   |   CompPrice > 142: Yes (41.87/0.71)
## |   Price > 156: No (13.68/0.81)
##
## Number of Leaves  :   13
##
## Size of the tree :   24
##
##
## Weight: 1.78
##
## J48 pruned tree
## ------------------
##
## Age <= 60
## |   Age <= 55
## |   |   Advertising <= 18
## |   |   |   ShelveLoc = Bad
## |   |   |   |   CompPrice <= 133: No (14.27/2.13)
## |   |   |   |   CompPrice > 133: Yes (12.86/3.7)
## |   |   |   ShelveLoc = Good: Yes (23.44/5.77)
## |   |   |   ShelveLoc = Medium
## |   |   |   |   Urban = No: No (19.11/8.96)
## |   |   |   |   Urban = Yes
## |   |   |   |   |   Price <= 117: Yes (22.79/2.75)
## |   |   |   |   |   Price > 117
## |   |   |   |   |   |   CompPrice <= 135: No (11.82/3.05)
```

```
## |   |   |   |   |   |   CompPrice > 135: Yes (10.3/3.54)
## |   |   Advertising > 18: Yes (12.82/0.35)
## |   Age > 55: Yes (42.68/3.74)
## Age > 60
## |   Age <= 79
## |   |   Price <= 89: Yes (11.29/1.32)
## |   |   Price > 89
## |   |   |   Age <= 76
## |   |   |   |   Advertising <= 5
## |   |   |   |   |   Population <= 149: No (11.76/1.0)
## |   |   |   |   |   Population > 149: Yes (32.28/1.46)
## |   |   |   |   Advertising > 5
## |   |   |   |   |   Population <= 382: No (33.03/1.31)
## |   |   |   |   |   Population > 382: Yes (10.04/4.39)
## |   |   |   Age > 76: No (18.56)
## |   Age > 79: Yes (13.94/2.57)
##
## Number of Leaves  :  16
##
## Size of the tree :   30
##
##
## Weight: 1.71
##
## J48 pruned tree
## ------------------
##
## Price <= 135
## |   Income <= 114
## |   |   Age <= 49
## |   |   |   ShelveLoc = Bad
## |   |   |   |   Price <= 125: Yes (15.69/3.75)
## |   |   |   |   Price > 125: No (11.97/1.38)
## |   |   |   ShelveLoc = Good: Yes (9.97/3.66)
## |   |   |   ShelveLoc = Medium: Yes (62.63/9.55)
## |   |   Age > 49
## |   |   |   ShelveLoc = Bad
## |   |   |   |   Age <= 63: Yes (11.51/2.26)
## |   |   |   |   Age > 63: No (10.64/1.28)
## |   |   |   ShelveLoc = Good: Yes (13.56)
## |   |   |   ShelveLoc = Medium
## |   |   |   |   Income <= 66
## |   |   |   |   |   Age <= 67
## |   |   |   |   |   |   Price <= 107: Yes (11.36/4.46)
## |   |   |   |   |   |   Price > 107: No (10.25/0.12)
## |   |   |   |   |   Age > 67: Yes (11.59/0.15)
## |   |   |   |   Income > 66: No (53.11/9.03)
## |   Income > 114: Yes (13.85/0.01)
## Price > 135: No (64.87/11.77)
##
## Number of Leaves  :  13
##
## Size of the tree :   23
##
```

```
##
## Weight: 1.68
##
## J48 pruned tree
## ------------------
##
## Income <= 61
## |    Education <= 16
## |    |    Price <= 100: Yes (12.76/4.67)
## |    |    Price > 100: No (75.8/9.75)
## |    Education > 16: Yes (15.52/5.7)
## Income > 61
## |    Income <= 67: Yes (30.76/1.77)
## |    Income > 67
## |    |    Income <= 70: No (23.3/2.81)
## |    |    Income > 70
## |    |    |    ShelveLoc = Bad
## |    |    |    |    Advertising <= 7: No (10.74/0.48)
## |    |    |    |    Advertising > 7: Yes (16.5/5.19)
## |    |    |    ShelveLoc = Good: Yes (24.59/2.19)
## |    |    |    ShelveLoc = Medium
## |    |    |    |    Population <= 449
## |    |    |    |    |    Advertising <= 15
## |    |    |    |    |    |    Advertising <= 5
## |    |    |    |    |    |    |    Population <= 213
## |    |    |    |    |    |    |    |    Income <= 82: Yes (11.73/0.13)
## |    |    |    |    |    |    |    |    Income > 82: No (20.5/5.34)
## |    |    |    |    |    |    |    Population > 213: Yes (22.9/0.2)
## |    |    |    |    |    |    Advertising > 5: No (13.08/3.49)
## |    |    |    |    |    Advertising > 15: Yes (11.2)
## |    |    |    |    Population > 449: No (11.63/1.85)
##
## Number of Leaves  :   14
##
## Size of the tree :    26
##
##
## Weight: 1.78
##
## J48 pruned tree
## ------------------
##
## CompPrice <= 124
## |    Income <= 59: No (65.51/8.32)
## |    Income > 59
## |    |    Price <= 131
## |    |    |    Urban = No: Yes (17.7/0.55)
## |    |    |    Urban = Yes
## |    |    |    |    Price <= 86: Yes (12.35)
## |    |    |    |    Price > 86: No (32.56/10.12)
## |    |    Price > 131: No (12.81/0.0)
## CompPrice > 124
## |    Income <= 107
## |    |    Price <= 126: Yes (79.69/8.12)
```

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```
## |   |   Price > 126
## |   |   |   Income <= 82
## |   |   |   |   Education <= 12: Yes (13.07/3.53)
## |   |   |   |   Education > 12: No (32.77/8.09)
## |   |   |   Income > 82: Yes (19.47/1.35)
## |   Income > 107: No (15.07/0.39)
##
## Number of Leaves  :  10
##
## Size of the tree :   19
##
##
## Weight: 1.86
##
## J48 pruned tree
## ------------------
##
## Advertising <= 21
## |   Price <= 139
## |   |   ShelveLoc = Bad
## |   |   |   Education <= 17
## |   |   |   |   Advertising <= 14
## |   |   |   |   |   Population <= 372: No (31.85/2.59)
## |   |   |   |   |   Population > 372: Yes (11.33/4.22)
## |   |   |   |   Advertising > 14: Yes (12.44/0.75)
## |   |   |   Education > 17: Yes (10.25/0.13)
## |   |   ShelveLoc = Good: Yes (34.34/4.46)
## |   |   ShelveLoc = Medium
## |   |   |   Price <= 99: Yes (45.77/6.17)
## |   |   |   Price > 99
## |   |   |   |   Education <= 10: Yes (12.02/0.67)
## |   |   |   |   Education > 10
## |   |   |   |   |   Income <= 96: No (69.46/21.22)
## |   |   |   |   |   Income > 96: Yes (15.61/2.26)
## |   Price > 139
## |   |   US = No: Yes (13.4/5.71)
## |   |   US = Yes: No (25.2/0.55)
## Advertising > 21: Yes (19.33)
##
## Number of Leaves  :  12
##
## Size of the tree :   22
##
##
## Weight: 1.64
##
## J48 pruned tree
## ------------------
##
## Advertising <= 0
## |   Income <= 42: No (38.83/3.54)
## |   Income > 42
## |   |   ShelveLoc = Bad: No (13.47/4.62)
## |   |   ShelveLoc = Good: Yes (12.38/3.96)
```

```
## |   |    ShelveLoc = Medium
## |   |   |   Education <= 12: No (10.61/1.12)
## |   |   |   Education > 12
## |   |   |   |   Population <= 192: Yes (17.41/5.33)
## |   |   |   |   Population > 192: No (14.75/2.33)
## Advertising > 0
## |    ShelveLoc = Bad
## |   |    Population <= 300: Yes (27.31/9.05)
## |   |    Population > 300: No (24.04/2.7)
## |    ShelveLoc = Good: Yes (16.26/4.15)
## |    ShelveLoc = Medium
## |   |    Income <= 89: Yes (111.69/16.37)
## |   |    Income > 89: No (14.25/4.28)
##
## Number of Leaves  :   11
##
## Size of the tree :    19
##
##
## Weight: 1.44
##
## J48 pruned tree
## ------------------
##
## Price <= 139
## |    CompPrice <= 109
## |   |    Income <= 52: No (29.69/0.0)
## |   |    Income > 52
## |   |   |    Age <= 66: Yes (19.09/4.9)
## |   |   |    Age > 66: No (10.62/1.56)
## |    CompPrice > 109
## |   |    Income <= 24: No (11.0)
## |   |    Income > 24
## |   |   |    Income <= 27: Yes (17.4/0.0)
## |   |   |    Income > 27
## |   |   |   |    Price <= 101: Yes (29.52/2.67)
## |   |   |   |    Price > 101
## |   |   |   |   |    ShelveLoc = Bad
## |   |   |   |   |   |    Population <= 402: No (19.1/4.7)
## |   |   |   |   |   |    Population > 402: Yes (13.07/1.49)
## |   |   |   |   |    ShelveLoc = Good: Yes (13.65/0.34)
## |   |   |   |   |    ShelveLoc = Medium
## |   |   |   |   |   |    Education <= 16
## |   |   |   |   |   |   |    Urban = No
## |   |   |   |   |   |   |   |    US = No: Yes (10.32/4.09)
## |   |   |   |   |   |   |   |    US = Yes: No (11.83/2.03)
## |   |   |   |   |   |   |    Urban = Yes
## |   |   |   |   |   |   |   |    CompPrice <= 125: No (16.5/4.96)
## |   |   |   |   |   |   |   |    CompPrice > 125: Yes (26.46/2.84)
## |   |   |   |   |   |    Education > 16: No (17.89/3.11)
## Price > 139: No (54.86/9.47)
##
## Number of Leaves  :   15
##
```

```
## Size of the tree :    28
##
##
## Weight: 1.81
##
## J48 pruned tree
## ------------------
##
## Advertising <= 21
## |   CompPrice <= 143
## |   |   Income <= 113
## |   |   |   Advertising <= 7
## |   |   |   |   Population <= 198: No (56.15/4.02)
## |   |   |   |   Population > 198
## |   |   |   |   |   Price <= 124
## |   |   |   |   |   |   Price <= 118
## |   |   |   |   |   |   |   Education <= 12: Yes (15.06/4.21)
## |   |   |   |   |   |   |   Education > 12: No (28.25/6.74)
## |   |   |   |   |   |   Price > 118: Yes (10.11)
## |   |   |   |   |   Price > 124: No (21.79/0.12)
## |   |   |   Advertising > 7
## |   |   |   |   Price <= 126
## |   |   |   |   |   CompPrice <= 121
## |   |   |   |   |   |   Advertising <= 13: Yes (11.37/3.96)
## |   |   |   |   |   |   Advertising > 13: No (10.7/3.31)
## |   |   |   |   |   CompPrice > 121: Yes (33.9/3.94)
## |   |   |   |   Price > 126
## |   |   |   |   |   Advertising <= 11: Yes (11.24/4.62)
## |   |   |   |   |   Advertising > 11: No (14.98/0.57)
## |   |   Income > 113: Yes (12.63/0.12)
## |   CompPrice > 143
## |   |   Price <= 149: Yes (38.09/1.28)
## |   |   Price > 149: No (11.89/4.17)
## Advertising > 21: Yes (24.84)
##
## Number of Leaves  :   14
##
## Size of the tree :    27
##
##
## Weight: 1.96
##
## J48 pruned tree
## ------------------
##
## CompPrice <= 139
## |   Advertising <= 13
## |   |   Age <= 26: Yes (17.44/2.13)
## |   |   Age > 26
## |   |   |   Education <= 17
## |   |   |   |   Income <= 96: No (135.4/28.12)
## |   |   |   |   Income > 96
## |   |   |   |   |   Income <= 106: Yes (14.43/2.66)
## |   |   |   |   |   Income > 106: No (12.56/4.97)
```

```
## |   |   |   Education > 17: Yes (16.78/3.77)
## |   Advertising > 13: Yes (43.21/10.22)
## CompPrice > 139
## |   Population <= 112: Yes (31.72/0.14)
## |   Population > 112
## |   |   Population <= 388: No (12.69/3.36)
## |   |   Population > 388: Yes (16.75/1.66)
##
## Number of Leaves  :  9
##
## Size of the tree :   17
##
##
## Weight: 1.45
##
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad
## |   Advertising <= 3: Yes (22.18/5.39)
## |   Advertising > 3
## |   |   Price <= 125
## |   |   |   CompPrice <= 119: No (18.46/4.37)
## |   |   |   CompPrice > 119: Yes (12.52/2.45)
## |   |   Price > 125: No (17.84)
## ShelveLoc = Good: Yes (38.75/8.34)
## ShelveLoc = Medium
## |   Age <= 33: Yes (34.86/5.88)
## |   Age > 33
## |   |   Population <= 492
## |   |   |   Price <= 115
## |   |   |   |   Population <= 189: Yes (32.53/3.2)
## |   |   |   |   Population > 189
## |   |   |   |   |   Age <= 61: No (24.7/3.98)
## |   |   |   |   |   Age > 61: Yes (19.99/3.93)
## |   |   |   Price > 115
## |   |   |   |   CompPrice <= 131: No (30.93/0.59)
## |   |   |   |   CompPrice > 131
## |   |   |   |   |   CompPrice <= 142
## |   |   |   |   |   |   Income <= 65: Yes (11.3/4.47)
## |   |   |   |   |   |   Income > 65: No (10.87/0.0)
## |   |   |   |   |   CompPrice > 142: Yes (14.07/3.27)
## |   |   Population > 492: Yes (12.01/0.15)
##
## Number of Leaves  :  14
##
## Size of the tree :   26
##
##
## Weight: 1.71
##
## J48 pruned tree
## ------------------
##
```

```
## Income <= 98
## |   Urban = No: No (77.47/14.31)
## |   Urban = Yes
## |   |   ShelveLoc = Bad
## |   |   |   Income <= 81
## |   |   |   |   Advertising <= 3: Yes (13.77/4.87)
## |   |   |   |   Advertising > 3: No (15.8/3.71)
## |   |   |   Income > 81: No (16.68/0.14)
## |   |   ShelveLoc = Good
## |   |   |   Population <= 245: Yes (13.53/2.24)
## |   |   |   Population > 245: No (11.17/3.55)
## |   |   ShelveLoc = Medium
## |   |   |   Education <= 17
## |   |   |   |   Price <= 127
## |   |   |   |   |   CompPrice <= 128
## |   |   |   |   |   |   Advertising <= 0: No (13.36/3.14)
## |   |   |   |   |   |   Advertising > 0
## |   |   |   |   |   |   |   CompPrice <= 110: No (13.35/5.42)
## |   |   |   |   |   |   |   CompPrice > 110: Yes (18.47/2.28)
## |   |   |   |   |   CompPrice > 128: Yes (10.74/0.59)
## |   |   |   |   Price > 127: No (25.88/6.12)
## |   |   |   Education > 17: No (14.7/2.17)
## Income > 98
## |   Price <= 125: Yes (44.58/6.13)
## |   Price > 125: No (11.5/0.79)
##
## Number of Leaves  :  14
##
## Size of the tree :   26
##
##
## Weight: 1.49
##
## J48 pruned tree
## ------------------
##
## Price <= 81: Yes (21.34/1.44)
## Price > 81
## |   Age <= 76
## |   |   Advertising <= 8
## |   |   |   Education <= 17
## |   |   |   |   Education <= 11: Yes (27.32/9.64)
## |   |   |   |   Education > 11
## |   |   |   |   |   Urban = No
## |   |   |   |   |   |   Income <= 65: No (16.15/0.26)
## |   |   |   |   |   |   Income > 65: Yes (15.57/2.87)
## |   |   |   |   |   Urban = Yes: No (66.35/12.36)
## |   |   |   Education > 17: Yes (15.7/3.85)
## |   |   Advertising > 8
## |   |   |   Price <= 105: Yes (44.06/3.25)
## |   |   |   Price > 105
## |   |   |   |   CompPrice <= 137
## |   |   |   |   |   CompPrice <= 113: No (13.72/0.05)
## |   |   |   |   |   CompPrice > 113
```

```
## |   |   |   |   |   |        CompPrice <= 118: Yes (10.03/0.14)
## |   |   |   |   |   |        CompPrice > 118
## |   |   |   |   |   |   |     Education <= 14
## |   |   |   |   |   |   |   |   Advertising <= 14: No (10.5/4.47)
## |   |   |   |   |   |   |   |   Advertising > 14: Yes (10.17/2.9)
## |   |   |   |   |   |   |     Education > 14: No (12.21/0.52)
## |   |   |   |   CompPrice > 137: Yes (20.82/0.68)
## |   Age > 76: No (17.06/0.94)
##
## Number of Leaves  :  14
##
## Size of the tree :   27
##
##
## Weight: 1.78
##
## J48 pruned tree
## ------------------
##
## Education <= 12
## |   Age <= 74
## |   |   ShelveLoc = Bad: No (11.66/3.39)
## |   |   ShelveLoc = Good: Yes (6.17/0.69)
## |   |   ShelveLoc = Medium
## |   |   |   Income <= 62: No (36.92/5.93)
## |   |   |   Income > 62: Yes (16.26/7.11)
## |   Age > 74: No (14.92)
## Education > 12
## |   Income <= 107
## |   |   Education <= 17
## |   |   |   ShelveLoc = Bad
## |   |   |   |   Age <= 40: No (11.82/0.19)
## |   |   |   |   Age > 40
## |   |   |   |   |   Age <= 60: Yes (19.25/3.59)
## |   |   |   |   |   Age > 60: No (11.52/2.14)
## |   |   |   ShelveLoc = Good: Yes (36.51/8.56)
## |   |   |   ShelveLoc = Medium
## |   |   |   |   US = No: Yes (31.43/6.05)
## |   |   |   |   US = Yes
## |   |   |   |   |   Income <= 27: Yes (17.93/0.5)
## |   |   |   |   |   Income > 27
## |   |   |   |   |   |   Urban = No: No (11.08/4.12)
## |   |   |   |   |   |   Urban = Yes
## |   |   |   |   |   |   |   Education <= 16
## |   |   |   |   |   |   |   |   Income <= 66: Yes (11.54/3.04)
## |   |   |   |   |   |   |   |   Income > 66: No (10.38/0.09)
## |   |   |   |   |   |   |   Education > 16: Yes (11.37/0.72)
## |   |   Education > 17
## |   |   |   Population <= 97: No (13.33/0.44)
## |   |   |   Population > 97: Yes (12.41/4.03)
## |   Income > 107: No (16.51/1.64)
##
## Number of Leaves  :  18
##
```

```
## Size of the tree :    33
##
##
## Weight: 1.56
##
## J48 pruned tree
## ------------------
##
## Price <= 156
## |   Advertising <= 7
## |   |   Population <= 492
## |   |   |   Age <= 76
## |   |   |   |   CompPrice <= 131
## |   |   |   |   |   Advertising <= 5
## |   |   |   |   |   |   Population <= 210: No (57.3/4.9)
## |   |   |   |   |   |   Population > 210
## |   |   |   |   |   |   |   Population <= 408: Yes (11.39/2.03)
## |   |   |   |   |   |   |   Population > 408: No (11.52/0.67)
## |   |   |   |   |   Advertising > 5: Yes (10.03/3.06)
## |   |   |   |   CompPrice > 131
## |   |   |   |   |   Price <= 118: Yes (12.72)
## |   |   |   |   |   Price > 118
## |   |   |   |   |   |   US = No
## |   |   |   |   |   |   |   Urban = No: No (10.32/3.68)
## |   |   |   |   |   |   |   Urban = Yes: Yes (12.16/3.75)
## |   |   |   |   |   |   US = Yes: No (11.72/1.45)
## |   |   |   Age > 76: No (16.04)
## |   |   Population > 492: Yes (15.22/1.85)
## |   Advertising > 7
## |   |   Price <= 102: Yes (19.41/0.02)
## |   |   Price > 102
## |   |   |   CompPrice <= 121: No (37.95/10.28)
## |   |   |   CompPrice > 121
## |   |   |   |   ShelveLoc = Bad: No (11.13/5.56)
## |   |   |   |   ShelveLoc = Good: Yes (9.44)
## |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   Price <= 127: Yes (19.8/0.95)
## |   |   |   |   |   Price > 127: No (12.55/3.97)
## Price > 156: No (22.32/0.47)
##
## Number of Leaves  :   17
##
## Size of the tree :    32
##
##
## Weight: 1.8
##
## J48 pruned tree
## ------------------
##
## Price <= 70: Yes (18.47)
## Price > 70
## |   Advertising <= 7
## |   |   CompPrice <= 109: No (24.49/0.16)
```

```
## |   |     CompPrice > 109
## |   |   |   CompPrice <= 147
## |   |   |   |   Price <= 129
## |   |   |   |   |   ShelveLoc = Bad: No (15.83/4.75)
## |   |   |   |   |   ShelveLoc = Good: Yes (8.84)
## |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   Age <= 50: Yes (22.35/8.69)
## |   |   |   |   |   |   Age > 50: No (41.07/8.73)
## |   |   |   |   Price > 129: No (22.82)
## |   |   |   CompPrice > 147: Yes (17.47/4.67)
## |   Advertising > 7
## |   |   Age <= 43: Yes (64.94/3.58)
## |   |   Age > 43
## |   |   |   Price <= 102: Yes (10.43/0.07)
## |   |   |   Price > 102
## |   |   |   |   ShelveLoc = Bad: No (5.27)
## |   |   |   |   ShelveLoc = Good: Yes (14.12/2.87)
## |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   Population <= 396: No (20.94/5.68)
## |   |   |   |   |   Population > 396: Yes (13.96/3.31)
##
## Number of Leaves  :   14
##
## Size of the tree :   25
##
##
## Weight: 1.81
##
## J48 pruned tree
## ------------------
##
## Price <= 115
## |   CompPrice <= 123
## |   |   ShelveLoc = Bad: No (21.68/5.52)
## |   |   ShelveLoc = Good: Yes (3.69/1.75)
## |   |   ShelveLoc = Medium
## |   |   |   Urban = No: Yes (29.13/3.22)
## |   |   |   Urban = Yes
## |   |   |   |   CompPrice <= 116: Yes (21.18/3.51)
## |   |   |   |   CompPrice > 116: No (11.81/0.79)
## |   CompPrice > 123: Yes (52.51/2.51)
## Price > 115
## |   Advertising <= 21
## |   |   Price <= 156
## |   |   |   CompPrice <= 131: No (69.49/8.56)
## |   |   |   CompPrice > 131
## |   |   |   |   Advertising <= 3
## |   |   |   |   |   Income <= 63: No (13.85/2.07)
## |   |   |   |   |   Income > 63: Yes (10.25/3.79)
## |   |   |   |   Advertising > 3: Yes (30.11/7.02)
## |   |   Price > 156: No (25.09)
## |   Advertising > 21: Yes (12.21)
##
## Number of Leaves  :   12
```

```
## 
## Size of the tree :    22
## 
## 
## Weight: 1.91
## 
## J48 pruned tree
## ------------------
## 
## Age <= 27: No (22.3/1.44)
## Age > 27
## |   Price <= 135
## |   |   ShelveLoc = Bad
## |   |   |   Advertising <= 7
## |   |   |   |   Advertising <= 2
## |   |   |   |   |   Education <= 13: Yes (16.04/1.82)
## |   |   |   |   |   Education > 13: No (10.55/3.89)
## |   |   |   |   Advertising > 2: No (15.54/4.5)
## |   |   |   Advertising > 7: Yes (27.62/3.87)
## |   |   ShelveLoc = Good: Yes (20.99)
## |   |   ShelveLoc = Medium
## |   |   |   Population <= 492
## |   |   |   |   Advertising <= 10
## |   |   |   |   |   Price <= 104
## |   |   |   |   |   |   Age <= 60: Yes (10.7/1.33)
## |   |   |   |   |   |   Age > 60: No (27.68/8.51)
## |   |   |   |   |   Price > 104: No (50.35/6.74)
## |   |   |   |   Advertising > 10
## |   |   |   |   |   Population <= 263: Yes (24.24/1.05)
## |   |   |   |   |   Population > 263: No (21.91/7.19)
## |   |   |   Population > 492: Yes (14.33/0.97)
## |   Price > 135: No (38.74/7.42)
## 
## Number of Leaves  :   13
## 
## Size of the tree :    24
## 
## 
## Weight: 1.64
## 
## J48 pruned tree
## ------------------
## 
## Advertising <= 21
## |   Price <= 70: Yes (19.41)
## |   Price > 70
## |   |   Income <= 116
## |   |   |   Price <= 144
## |   |   |   |   CompPrice <= 146
## |   |   |   |   |   CompPrice <= 99: No (11.59/0.1)
## |   |   |   |   |   CompPrice > 99
## |   |   |   |   |   |   ShelveLoc = Bad
## |   |   |   |   |   |   |   Price <= 102: Yes (22.85/3.63)
## |   |   |   |   |   |   |   Price > 102: No (28.9/3.99)
```

```
## |   |   |   |   |   |       ShelveLoc = Good: Yes (15.62/2.11)
## |   |   |   |   |   |       ShelveLoc = Medium
## |   |   |   |   |   |   |   Advertising <= 0
## |   |   |   |   |   |   |   |   CompPrice <= 118: No (16.29)
## |   |   |   |   |   |   |   |   CompPrice > 118
## |   |   |   |   |   |   |   |   |   Population <= 125: No (12.0/2.25)
## |   |   |   |   |   |   |   |   |   Population > 125: Yes (14.89/3.84)
## |   |   |   |   |   |   |   Advertising > 0
## |   |   |   |   |   |   |   |   US = No: Yes (16.69/0.65)
## |   |   |   |   |   |   |   |   US = Yes
## |   |   |   |   |   |   |   |   |   Age <= 44: Yes (20.6/1.77)
## |   |   |   |   |   |   |   |   |   Age > 44
## |   |   |   |   |   |   |   |   |   |   Population <= 279: Yes (22.29/6.77)
## |   |   |   |   |   |   |   |   |   |   Population > 279: No (16.43/1.9)
## |   |   |   |   CompPrice > 146: Yes (29.79/2.46)
## |   |   |   Price > 144: No (21.63/4.07)
## |   |   Income > 116: Yes (14.11/0.12)
## Advertising > 21: Yes (17.93)
##
## Number of Leaves  :   16
##
## Size of the tree :    30
##
##
## Weight: 2.07
##
## J48 pruned tree
## ------------------
##
## Income <= 94
## |   Urban = No
## |   |   CompPrice <= 113: No (37.42/1.5)
## |   |   CompPrice > 113
## |   |   |   Price <= 124: Yes (16.07/5.91)
## |   |   |   Price > 124: No (15.04/0.7)
## |   Urban = Yes
## |   |   Advertising <= 21
## |   |   |   Price <= 81: Yes (12.42/0.44)
## |   |   |   Price > 81
## |   |   |   |   CompPrice <= 111: No (26.35/1.56)
## |   |   |   |   CompPrice > 111
## |   |   |   |   |   CompPrice <= 157
## |   |   |   |   |   |   CompPrice <= 146
## |   |   |   |   |   |   |   Price <= 126
## |   |   |   |   |   |   |   |   Advertising <= 3
## |   |   |   |   |   |   |   |   |   Price <= 104: Yes (13.26/2.53)
## |   |   |   |   |   |   |   |   |   Price > 104: No (18.47/2.33)
## |   |   |   |   |   |   |   |   Advertising > 3: Yes (28.96/2.55)
## |   |   |   |   |   |   |   Price > 126: No (28.65/4.06)
## |   |   |   |   |   |   CompPrice > 146: Yes (15.77/1.17)
## |   |   |   |   |   CompPrice > 157: No (10.28/0.0)
## |   |   Advertising > 21: Yes (10.09)
## Income > 94: Yes (68.22/10.03)
##
```

```
## Number of Leaves  :   13
##
## Size of the tree :   25
##
##
## Weight: 2.1
##
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad
## |   Age <= 43
## |   |   Advertising <= 10
## |   |   |   Income <= 68: Yes (13.75/5.35)
## |   |   |   Income > 68: No (11.99/0.33)
## |   |   Advertising > 10: Yes (10.86/0.18)
## |   Age > 43: No (33.96/4.7)
## ShelveLoc = Good
## |   Urban = No: No (12.71/4.36)
## |   Urban = Yes: Yes (43.83/5.8)
## ShelveLoc = Medium
## |   Price <= 90: Yes (12.33/0.72)
## |   Price > 90
## |   |   Advertising <= 11
## |   |   |   US = No
## |   |   |   |   CompPrice <= 119: No (19.02)
## |   |   |   |   CompPrice > 119
## |   |   |   |   |   Income <= 108
## |   |   |   |   |   |   Education <= 16: Yes (19.84/6.86)
## |   |   |   |   |   |   Education > 16: No (13.1/4.01)
## |   |   |   |   |   Income > 108: No (12.76)
## |   |   |   US = Yes: No (60.48/9.22)
## |   |   Advertising > 11
## |   |   |   Age <= 44: Yes (16.86/1.28)
## |   |   |   Age > 44: No (19.5/6.5)
##
## Number of Leaves  :   14
##
## Size of the tree :   26
##
##
## Weight: 1.63
##
## J48 pruned tree
## ------------------
##
## Advertising <= 10
## |   ShelveLoc = Bad
## |   |   Age <= 57: No (36.05/6.03)
## |   |   Age > 57: Yes (17.58/5.39)
## |   ShelveLoc = Good: Yes (22.17/4.22)
## |   ShelveLoc = Medium
## |   |   Education <= 13: No (55.28/9.41)
## |   |   Education > 13
```

```
## |   |   |   Age <= 54
## |   |   |   |   Advertising <= 6: Yes (13.82/6.34)
## |   |   |   |   Advertising > 6: No (10.52)
## |   |   |   Age > 54
## |   |   |   |   Urban = No: Yes (15.13/1.44)
## |   |   |   |   Urban = Yes
## |   |   |   |   |   Population <= 133: Yes (11.48/0.61)
## |   |   |   |   |   Population > 133: No (10.79/1.46)
## Advertising > 10
## |   Price <= 131: Yes (76.51/13.73)
## |   Price > 131: No (31.67/5.19)
##
## Number of Leaves  :   11
##
## Size of the tree :    20
##
##
## Weight: 1.52
##
## J48 pruned tree
## ------------------
##
## Population <= 173
## |   Age <= 70
## |   |   CompPrice <= 139: No (65.3/16.14)
## |   |   CompPrice > 139: Yes (18.13/3.49)
## |   Age > 70: No (26.19)
## Population > 173
## |   Advertising <= 21
## |   |   ShelveLoc = Bad
## |   |   |   Income <= 48: No (12.11)
## |   |   |   Income > 48
## |   |   |   |   Price <= 102: Yes (14.19/1.01)
## |   |   |   |   Price > 102: No (21.95/5.62)
## |   |   ShelveLoc = Good
## |   |   |   Price <= 132: Yes (15.46)
## |   |   |   Price > 132: No (11.53/3.53)
## |   |   ShelveLoc = Medium
## |   |   |   Age <= 55
## |   |   |   |   Age <= 40: Yes (18.57/7.21)
## |   |   |   |   Age > 40: No (25.75/2.54)
## |   |   |   Age > 55
## |   |   |   |   Advertising <= 14: Yes (48.54/7.34)
## |   |   |   |   Advertising > 14: No (10.51/1.42)
## |   Advertising > 21: Yes (12.78)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
##
##
## Weight: 1.65
##
## J48 pruned tree
```

```
## ------------------
##
## Advertising <= 15
## |   Price <= 156
## |   |   CompPrice <= 123
## |   |   |   Price <= 100
## |   |   |   |   Advertising <= 7
## |   |   |   |   |   Price <= 96
## |   |   |   |   |   |   Price <= 81: Yes (10.43/3.28)
## |   |   |   |   |   |   Price > 81: No (15.8/0.12)
## |   |   |   |   |   Price > 96: Yes (12.6/2.02)
## |   |   |   |   Advertising > 7: Yes (13.23/1.02)
## |   |   |   Price > 100
## |   |   |   |   ShelveLoc = Bad: No (9.82/0.78)
## |   |   |   |   ShelveLoc = Good: Yes (11.76/4.08)
## |   |   |   |   ShelveLoc = Medium: No (48.4/6.27)
## |   |   CompPrice > 123
## |   |   |   Price <= 107: Yes (17.53/0.01)
## |   |   |   Price > 107
## |   |   |   |   ShelveLoc = Bad
## |   |   |   |   |   CompPrice <= 149: No (11.08/4.0)
## |   |   |   |   |   CompPrice > 149: Yes (11.02/0.95)
## |   |   |   |   ShelveLoc = Good: Yes (19.27/1.77)
## |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   Education <= 16
## |   |   |   |   |   |   Urban = No: No (20.67/7.75)
## |   |   |   |   |   |   Urban = Yes: Yes (30.26/4.74)
## |   |   |   |   |   Education > 16: No (20.68/2.22)
## |   Price > 156: No (16.21)
## Advertising > 15: Yes (32.24/5.78)
##
## Number of Leaves  :   16
##
## Size of the tree :    29
##
##
## Weight: 1.74
##
## J48 pruned tree
## ------------------
##
## Income <= 48
## |   Population <= 125: Yes (20.25/4.2)
## |   Population > 125
## |   |   US = No: No (45.04/3.33)
## |   |   US = Yes
## |   |   |   Age <= 50: Yes (13.35/3.27)
## |   |   |   Age > 50: No (23.11/2.12)
## Income > 48
## |   Price <= 126
## |   |   Income <= 100
## |   |   |   Price <= 104
## |   |   |   |   Income <= 68: Yes (11.98/0.03)
## |   |   |   |   Income > 68
```

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```
## |   |   |   |   |     CompPrice <= 116: Yes (13.93/4.24)
## |   |   |   |   |     CompPrice > 116: No (13.41/3.19)
## |   |   |   Price > 104
## |   |   |   |   CompPrice <= 124: No (18.18/0.19)
## |   |   |   |   CompPrice > 124: Yes (34.32/6.62)
## |   |     Income > 100: Yes (48.55/3.56)
## |   Price > 126
## |   |   Age <= 49: No (29.86/3.05)
## |   |   Age > 49
## |   |   |   Population <= 298: No (12.82/2.34)
## |   |   |   Population > 298: Yes (16.2/0.7)
##
## Number of Leaves  :   13
##
## Size of the tree :    25
##
##
## Weight: 1.97
##
## J48 pruned tree
## ------------------
##
## Income <= 24: No (19.59)
## Income > 24
## |   CompPrice <= 114
## |   |   Price <= 105
## |   |   |   Price <= 96: No (36.43/6.74)
## |   |   |   Price > 96: Yes (11.96/2.57)
## |   |   Price > 105: No (25.21/0.94)
## |   CompPrice > 114
## |   |   Advertising <= 0
## |   |   |   Age <= 70
## |   |   |   |   Education <= 12: No (15.31/2.12)
## |   |   |   |   Education > 12
## |   |   |   |   |   Education <= 13: Yes (15.13/0.0)
## |   |   |   |   |   Education > 13
## |   |   |   |   |   |   Age <= 55: No (19.27/5.42)
## |   |   |   |   |   |   Age > 55: Yes (11.2/0.65)
## |   |   |   Age > 70: No (19.01)
## |   |   Advertising > 0
## |   |   |   US = No: Yes (17.36/2.01)
## |   |   |   US = Yes
## |   |   |   |   CompPrice <= 116: Yes (11.94)
## |   |   |   |   CompPrice > 116
## |   |   |   |   |   Education <= 10: Yes (15.23/1.26)
## |   |   |   |   |   Education > 10
## |   |   |   |   |   |   Income <= 70: No (37.69/10.65)
## |   |   |   |   |   |   Income > 70
## |   |   |   |   |   |   |   Advertising <= 6: No (10.88/3.48)
## |   |   |   |   |   |   |   Advertising > 6: Yes (34.78/4.94)
##
## Number of Leaves  :   15
##
## Size of the tree :    29
```

```
##
##
## Weight: 1.85
##
## J48 pruned tree
## ------------------
##
## ShelveLoc = Bad
## |   Age <= 63
## |   |   CompPrice <= 131: No (19.42/7.29)
## |   |   CompPrice > 131: Yes (28.26/6.42)
## |   Age > 63: No (24.86/2.35)
## ShelveLoc = Good: Yes (49.12/8.16)
## ShelveLoc = Medium
## |   Income <= 24: No (11.33)
## |   Income > 24
## |   |   Population <= 76: Yes (36.71/3.07)
## |   |   Population > 76
## |   |   |   Income <= 27: Yes (13.26/0.45)
## |   |   |   Income > 27
## |   |   |   |   Population <= 139: No (12.68/0.08)
## |   |   |   |   Population > 139
## |   |   |   |   |   Education <= 13
## |   |   |   |   |   |   Population <= 256: Yes (17.78/0.75)
## |   |   |   |   |   |   Population > 256
## |   |   |   |   |   |   |   Age <= 46: No (17.13/3.22)
## |   |   |   |   |   |   |   Age > 46: Yes (21.99/7.25)
## |   |   |   |   |   Education > 13
## |   |   |   |   |   |   Population <= 396: No (29.27/3.11)
## |   |   |   |   |   |   Population > 396: Yes (19.19/6.53)
##
## Number of Leaves  :   13
##
## Size of the tree :    24
##
##
## Weight: 1.64
##
## J48 pruned tree
## ------------------
##
## Price <= 92: Yes (44.92/7.92)
## Price > 92
## |   Age <= 60
## |   |   Income <= 112
## |   |   |   Income <= 101
## |   |   |   |   Population <= 226: Yes (49.51/10.23)
## |   |   |   |   Population > 226
## |   |   |   |   |   ShelveLoc = Bad: No (18.9/3.53)
## |   |   |   |   |   ShelveLoc = Good: Yes (11.42/0.55)
## |   |   |   |   |   ShelveLoc = Medium
## |   |   |   |   |   |   Urban = No: No (13.79/1.59)
## |   |   |   |   |   |   Urban = Yes
## |   |   |   |   |   |   |   CompPrice <= 134: No (14.63/2.48)
```

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```
## |   |   |   |   |   |   |    CompPrice > 134: Yes (10.11/1.94)
## |   |   |    Income > 101: Yes (13.99)
## |   |    Income > 112: No (12.22/0.22)
## |    Age > 60
## |   |    Population <= 57: No (19.38)
## |   |    Population > 57
## |   |   |    Education <= 14
## |   |   |   |    Age <= 73
## |   |   |   |   |    Advertising <= 4: Yes (15.21/0.82)
## |   |   |   |   |    Advertising > 4: No (34.46/4.02)
## |   |   |   |    Age > 73: No (13.73/2.45)
## |   |   |    Education > 14: No (28.73/3.31)
##
## Number of Leaves  :  14
##
## Size of the tree :   26
##
##
## Weight: 1.9
##
## Number of performed Iterations: 100
```

Predicción

```
#Prediction

sales_pred_adaboost <- predict(sales_model_adaboost, CarseatsNew_test)
```

Y comparamos lo predicho por el algoritmo con los datos etiquetados anteriormente

```
#confusion matrix
confusionMatrix(reference = CarseatsNew_test_labels, data = sales_pred_adaboost, mode = "everything", p
```

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction No Yes
##        No  41  12
##        Yes  9  37
##
##                Accuracy : 0.7879
##                  95% CI : (0.6942, 0.8636)
##     No Information Rate : 0.5051
##     P-Value [Acc > NIR] : 6.132e-09
##
##                   Kappa : 0.5755
##
##  Mcnemar's Test P-Value : 0.6625
##
##             Sensitivity : 0.7551
##             Specificity : 0.8200
##          Pos Pred Value : 0.8043
##          Neg Pred Value : 0.7736
```

```
##              Precision : 0.8043
##                 Recall : 0.7551
##                     F1 : 0.7789
##             Prevalence : 0.4949
##         Detection Rate : 0.3737
##   Detection Prevalence : 0.4646
##      Balanced Accuracy : 0.7876
##
##         'Positive' Class : Yes
##
```

Utilizando boosting (árboles no podados), se consigue mejorar el resultado de C5.0. Ahora se consigue una exactitud de casi el 82% (con 10 iteraciones)

Con 10 iteraciones:

```
        Reference
```

Prediction No Yes No 44 12 Yes 6 37

Accuracy : 0.8182

Con 100 iteraciones:

```
        Reference
```

Prediction No Yes No 41 12 Yes 9 37

Accuracy : 0.7879

MultiBoostAB

[NOTA 1

weka.classifiers.meta.**MultiBoostAB** Class for boosting a classifier using the MultiBoosting method.

MultiBoosting is an extension to the highly successful AdaBoost technique for forming decision committees. MultiBoosting can be viewed as combining AdaBoost with wagging. It is able to harness both AdaBoost's high bias and variance reduction with wagging's superior variance reduction. Using C4.5 as the base learning algorithm, Multi-boosting is demonstrated to produce decision committees with lower error than either AdaBoost or wagging significantly more often than the reverse over a large representative cross-section of UCI data sets. It offers the further advantage over AdaBoost of suiting parallel execution.

https://cml.rhul.ac.uk/people/davidl/javadoc/weka/classifiers/meta/MultiBoostAB.html]

[NOTA 2 Al intentar usar MultiBoostAB, me ha dado este error:

Error in WPM(".check-installed-and-load", package) : Required Weka package 'multiBoostAB' is not installed.

He tenido que instalarlo usando WPM ("Weka package manager")

WPM("list-packages", "installed") <- listado de paquetes instalados

WPM("list-packages", "available") <- listado de paquetes disponibles

WPM("install-package", "multiBoostAB") <- instalar un paquete

]

```
# Using MultiBoostAB

#sales_model_multiboost <- MultiBoostAB(SalesFactor ~ ., data = CarseatsNew_train, control = Weka_contr

#sales_model_multiboost
```

Predicción

```
#Prediction

#sales_pred_multiboost <- predict(sales_model_multiboost, CarseatsNew_test)
```

Y comparamos lo predicho por el algoritmo con los datos etiquetados anteriormente

```
#confusion matrix
#confusionMatrix(reference = CarseatsNew_test_labels, data = sales_pred_multiboost, mode = "everything"
```

Confusion Matrix and Statistics

```
          Reference

Prediction No Yes No 43 12 Yes 7 37

            Accuracy : 0.8081
              95% CI : (0.7166, 0.8803)
No Information Rate : 0.5051
P-Value [Acc > NIR] : 4.072e-10

               Kappa : 0.6157


Mcnemar's Test P-Value : 0.3588

         Sensitivity : 0.7551
         Specificity : 0.8600
      Pos Pred Value : 0.8409
      Neg Pred Value : 0.7818
           Precision : 0.8409
              Recall : 0.7551
                  F1 : 0.7957
          Prevalence : 0.4949
      Detection Rate : 0.3737

Detection Prevalence : 0.4444
Balanced Accuracy : 0.8076

    'Positive' Class : Yes
```

La exactitud es 80.81 %. Aunque en la documentación de Weka se indica que es mejor que AdaBoost, en nuestro caso el resultado ha sido ligeramente inferior. (Quizá el tamaño tan pequeño de los conjuntos de entrenamiento y test influyan. Tampoco creo que se puedan sacar conclusiones definitivas con estos tamaños).