Regression for Model 1

```
> summary(data)

Call:
glm(formula = formula, family = binomial, data = bank)

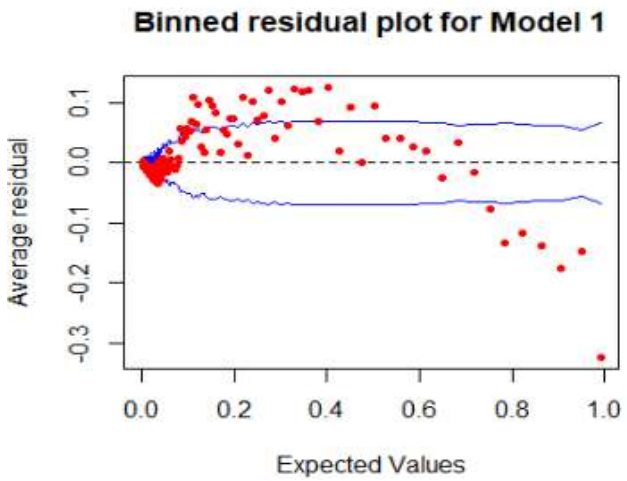
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-6.0055  -0.2970  -0.1850  -0.1332   3.3950

Coefficients: (1 not defined because of singularities)
                     Estimate Std. Error z value Pr(>|z|)
(Intercept)         -2.325e+02  3.830e+01  -6.070 1.28e-09 ***
age25.29            -1.908e-01  1.099e-01  -1.736 0.082500 .
age30.35            -2.691e-01  1.070e-01  -2.514 0.011950 *
age36.40            -4.326e-01  1.144e-01  -3.783 0.000155 ***
age41.45            -4.571e-01  1.209e-01  -3.783 0.000155 ***
age46.50            -4.296e-01  1.254e-01  -3.427 0.000611 ***
age51.55            -2.816e-01  1.285e-01  -2.191 0.028486 *
age56.60            -1.269e-01  1.324e-01  -0.959 0.337675
ageOver 61           1.947e-01  1.372e-01   1.418 0.156071
joblow              -1.239e-01  6.351e-02  -1.950 0.051171 .
jobmed              -3.881e-02  5.353e-02  -0.725 0.468528
maritalmarried      -2.358e-02  6.837e-02  -0.345 0.730203
maritalsingle       -7.368e-03  7.867e-02  -0.094 0.925389
maritalunknown      -6.278e-03  4.178e-01  -0.015 0.988011
educationlow        -2.364e-01  6.418e-02  -3.683 0.000230 ***
educationmed        -1.454e-01  4.997e-02  -2.909 0.003622 **
educationunknown    -9.657e-02  1.009e-01  -0.957 0.338573
defaultunknown      -2.848e-01  6.736e-02  -4.229 2.35e-05 ***
defaultyes          -7.188e+00  1.135e+02  -0.063 0.949480
housingunknown      -9.265e-02  1.395e-01  -0.664 0.506682
housingyes          -4.663e-03  4.135e-02  -0.113 0.910212
loanunknown                 NA         NA      NA       NA
loanyes             -4.896e-02  5.754e-02  -0.851 0.394815
contacttelephone    -6.434e-01  7.690e-02  -8.367  < 2e-16 ***
monthaug             8.627e-01  1.205e-01   7.161 8.02e-13 ***
monthdec             2.968e-01  2.087e-01   1.422 0.155077
monthjul             9.928e-02  9.654e-02   1.028 0.303730
monthjun            -5.359e-01  1.263e-01  -4.244 2.20e-05 ***
monthmar             1.981e+00  1.445e-01  13.705  < 2e-16 ***
monthmay            -4.641e-01  8.261e-02  -5.618 1.93e-08 ***
monthnov            -4.379e-01  1.211e-01  -3.616 0.000300 ***
monthoct             1.702e-01  1.540e-01   1.105 0.269016
monthsep             3.555e-01  1.797e-01   1.978 0.047891 *
day_of_weekmon      -1.203e-01  6.616e-02  -1.818 0.069048 .
day_of_weekthu       5.285e-02  6.409e-02   0.825 0.409643
day_of_weektue       9.387e-02  6.591e-02   1.424 0.154384
day_of_weekwed       1.676e-01  6.567e-02   2.552 0.010712 *
duration             4.713e-03  7.462e-05  63.156  < 2e-16 ***
campaign            -4.029e-02  1.155e-02  -3.488 0.000487 ***
pdays               -9.637e-04  2.169e-04  -4.444 8.83e-06 ***
previous            -6.374e-02  5.922e-02  -1.076 0.281772
poutcomenonexistent  4.290e-01  9.428e-02   4.551 5.35e-06 ***
poutcomesuccess      9.470e-01  2.113e-01   4.483 7.37e-06 ***
emp.var.rate        -1.757e+00  1.419e-01 -12.379  < 2e-16 ***
cons.price.idx       2.168e+00  2.524e-01   8.592  < 2e-16 ***
cons.conf.idx        1.961e-02  7.768e-03   2.524 0.011595 *
euribor3m            3.553e-01  1.299e-01   2.735 0.006237 **
nr.employed          5.113e-03  3.114e-03   1.642 0.100637
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 28999  on 41187  degrees of freedom
Residual deviance: 17059  on 41141  degrees of freedom
AIC: 17153
Number of Fisher Scoring iterations: 10
```

Binned plot for model 1



Regression for Model 2

```
> summary(data1)

Call:
glm(formula = formula1, family = binomial, data = bank)

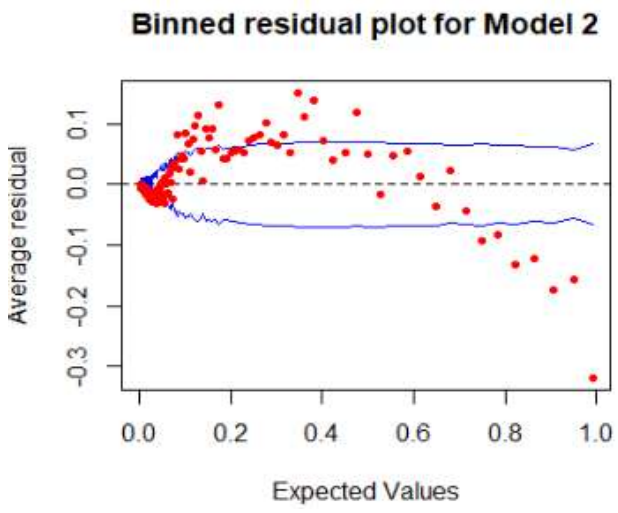
Deviance Residuals:
   Min      1Q  Median      3Q     Max
-6.0270  -0.2971  -0.1849  -0.1359   3.3257

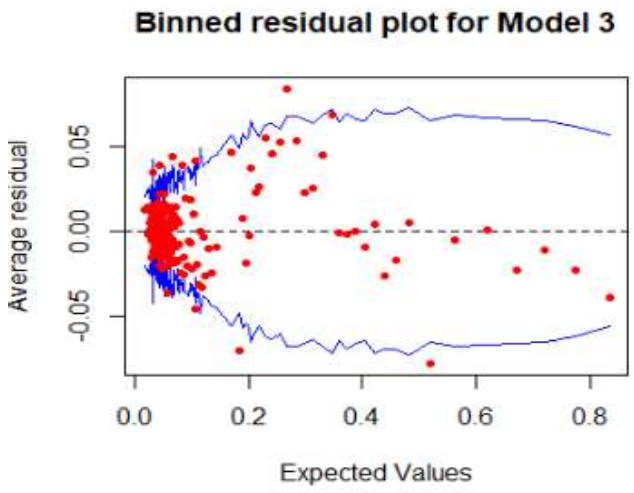
Coefficients:
                                   Estimate Std. Error z value Pr(>|z|)
(Intercept)                      -1.719e+02  1.030e+01 -16.695  < 2e-16 ***
age25.29                         -2.182e-01  1.083e-01  -2.014 0.043998 *
age30.35                         -3.018e-01  1.028e-01  -2.936 0.003327 **
age36.40                         -4.860e-01  1.084e-01  -4.484 7.31e-06 ***
age41.45                         -5.160e-01  1.131e-01  -4.563 5.05e-06 ***
age46.50                         -4.992e-01  1.168e-01  -4.272 1.94e-05 ***
age51.55                         -3.587e-01  1.193e-01  -3.007 0.002638 **
age56.60                         -2.122e-01  1.223e-01  -1.735 0.082805 .
ageOver 61                        1.035e-01  1.241e-01   0.834 0.404232
monthaug                          7.822e-01  1.067e-01   7.332 2.26e-13 ***
monthdec                          1.660e-01  1.953e-01   0.850 0.395352
monthjul                          1.061e-01  9.580e-02   1.108 0.267895
monthjun                         -4.343e-01  1.063e-01  -4.086 4.39e-05 ***
monthmar                          1.857e+00  1.165e-01  15.946  < 2e-16 ***
monthmay                         -5.289e-01  7.566e-02  -6.990 2.75e-12 ***
monthnov                         -5.180e-01  1.070e-01  -4.840 1.30e-06 ***
monthoct                          3.274e-02  1.239e-01   0.264 0.791613
monthsep                          1.654e-01  1.309e-01   1.263 0.206516
duration                         4.712e-03  7.439e-05  63.336  < 2e-16 ***
poutcomenonexistent               4.977e-01  6.398e-02   7.779 7.31e-15 ***
poutcomesuccess                   1.011e+00  2.033e-01   4.974 6.56e-07 ***
emp.var.rate                     -1.630e+00  1.130e-01 -14.416  < 2e-16 ***
cons.price.idx                    1.791e+00  1.068e-01  16.776  < 2e-16 ***
educationlow                     -3.153e-01  5.577e-02  -5.654 1.57e-08 ***
educationmed                     -1.453e-01  4.898e-02  -2.966 0.003014 **
educationunknown                 -1.250e-01  9.931e-02  -1.258 0.208304
factor(contact == "telephone")TRUE -6.109e-01  7.360e-02  -8.300  < 2e-16 ***
factor(day_of_week == "wed")TRUE   1.588e-01  5.070e-02   3.133 0.001730 **
campaign                         -4.216e-02  1.158e-02  -3.642 0.000271 ***
pdays                            -8.814e-04  2.029e-04  -4.345 1.39e-05 ***
euribor3m                         5.182e-01  8.579e-02   6.041 1.53e-09 ***
cons.conf.idx                     1.106e-02  5.486e-03   2.015 0.043896 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

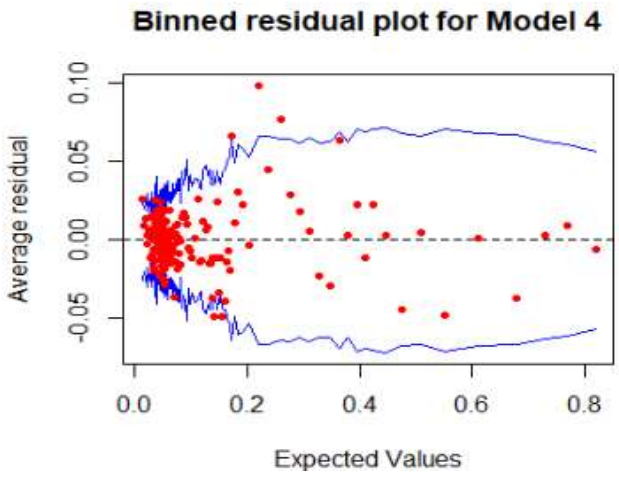
(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 28999  on 41187  degrees of freedom
Residual deviance: 17100  on 41156  degrees of freedom
AIC: 17164
Number of Fisher Scoring iterations: 6
```

Binned plot for model 2



Regression for Model 3	> summary(data2) Call: glm(formula = formula2, family = binomial, data = bank) Deviance Residuals: Min 1Q Median 3Q Max -2.0129 -0.3863 -0.3181 -0.2640 2.9700 Coefficients: Estimate Std. Error z value Pr(>|z|) (Intercept) -1.583e+02 8.780e+00 -18.031 < 2e-16 *** age25.29 -1.760e-01 9.622e-02 -1.830 0.067296 . age30.35 -2.214e-01 9.088e-02 -2.437 0.014830 * age36.40 -3.852e-01 9.579e-02 -4.021 5.79e-05 *** age41.45 -3.679e-01 9.958e-02 -3.694 0.000221 *** age46.50 -3.989e-01 1.031e-01 -3.869 0.000109 *** age51.55 -3.013e-01 1.052e-01 -2.863 0.004200 ** age56.60 -1.472e-01 1.078e-01 -1.365 0.172202 ageOver 61 2.993e-02 1.118e-01 0.268 0.788862 monthaug 5.888e-01 7.586e-02 7.763 8.33e-15 *** monthdec 4.269e-01 1.730e-01 2.467 0.013626 * monthjul 1.141e-01 8.008e-02 1.425 0.154262 monthjun -5.219e-01 9.237e-02 -5.650 1.61e-08 *** monthmar 1.387e+00 1.043e-01 13.290 < 2e-16 *** monthmay -4.560e-01 6.438e-02 -7.083 1.41e-12 *** monthnov -5.160e-01 9.217e-02 -5.598 2.17e-08 *** monthoct -1.761e-02 1.062e-01 -0.166 0.868224 monthsep 1.960e-01 1.057e-01 1.855 0.063665 . poutcomenonexistent 5.076e-01 5.664e-02 8.963 < 2e-16 *** poutcomesuccess 8.331e-01 1.881e-01 4.429 9.48e-06 *** emp.var.rate -1.457e+00 9.053e-02 -16.095 < 2e-16 *** cons.price.idx 1.659e+00 9.167e-02 18.104 < 2e-16 *** factor(contact == "telephone")TRUE -6.371e-01 6.142e-02 -10.372 < 2e-16 *** factor(day_of_week == "wed")TRUE 1.705e-01 4.397e-02 3.879 0.000105 *** campaign -4.448e-02 9.257e-03 -4.805 1.55e-06 *** pdays -1.041e-03 1.870e-04 -5.568 2.58e-08 *** euribor3m 5.291e-01 6.866e-02 7.706 1.30e-14 *** --- Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 (Dispersion parameter for binomial family taken to be 1) Null deviance: 28999 on 41187 degrees of freedom Residual deviance: 22798 on 41161 degrees of freedom AIC: 22852 Number of Fisher Scoring iterations: 6
Binned plot for model 3	

Regression for Model 4	> summary(data3) Call: glm(formula = formula3, family = binomial, data = bank) Deviance Residuals: Min 1Q Median 3Q Max -2.0092 -0.4011 -0.3219 -0.2789 2.9879 Coefficients: Estimate Std. Error z value Pr(>|z|) (Intercept) -1.268e+02 6.130e+00 -20.685 < 2e-16 *** age25.29 -1.960e-01 9.594e-02 -2.043 0.04108 * age30.35 -2.878e-01 9.049e-02 -3.180 0.00147 ** age36.40 -4.464e-01 9.534e-02 -4.682 2.84e-06 *** age41.45 -4.145e-01 9.914e-02 -4.181 2.90e-05 *** age46.50 -4.363e-01 1.026e-01 -4.252 2.12e-05 *** age51.55 -3.424e-01 1.048e-01 -3.268 0.00108 ** age56.60 -1.394e-01 1.074e-01 -1.298 0.19423 ageOver 61 1.578e-01 1.127e-01 1.400 0.16145 factor(month == "aug")TRUE 3.508e-01 6.835e-02 5.133 2.84e-07 *** poutcomenonexistent 5.748e-01 5.583e-02 10.297 < 2e-16 *** poutcomesuccess 8.281e-01 1.869e-01 4.431 9.39e-06 *** emp.var.rate -8.995e-01 6.599e-02 -13.629 < 2e-16 *** cons.price.idx 1.354e+00 6.350e-02 21.318 < 2e-16 *** factor(contact == "telephone")TRUE -8.792e-01 5.432e-02 -16.186 < 2e-16 *** factor(day_of_week == "wed")TRUE 1.341e-01 4.359e-02 3.076 0.00210 ** campaign -4.355e-02 9.279e-03 -4.693 2.69e-06 *** euribor3m 9.674e-02 4.993e-02 1.938 0.05267 . factor(education == "low")TRUE -1.921e-01 4.144e-02 -4.634 3.59e-06 *** pdays -1.048e-03 1.858e-04 -5.642 1.68e-08 *** cons.conf.idx 3.483e-02 4.265e-03 8.165 3.21e-16 *** --- Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 (Dispersion parameter for binomial family taken to be 1) Null deviance: 28999 on 41187 degrees of freedom Residual deviance: 23157 on 41167 degrees of freedom AIC: 23199 Number of Fisher Scoring iterations: 6
Binned plot for model 4	

Regression for Model 5

From the final model it is observed that the age 36.40 is the worst age group in order to get a positive answer since the negative number comes to -5.035e.. while the age group 56.60 and 25.29 are more likely to give a positive answer. The months October and March are the months where is highly likely the customer will answer positively as well as the outcome of the previous campaign plays a significant role. Also, it is likely that people that have been called in their telephone will give a negative answer and it seems that Wednesday is the best day to get a positive answer.

Variable that can significantly affect the outcome positively:
Month = December
Month = March
Month = October
Previous outcome = Success
Consumer price Index
Day of the week = Wednesday
Consumer Confidence Index

Variable that can significantly affect the outcome positively:
Campaign
Euribor3m
Education = Low / Medium
Pdays
Month = November
Month = August
All the age groups with the age group 56.60 to be the most likely to get a positive answer and 36.40 to be the most likely to get a negative answer.

```
> summary(data4)

Call:
glm(formula = formula4, family = binomial, data = data.rose)

Deviance Residuals:
   Min      1Q  Median      3Q     Max
-2.9978  -0.8828  -0.5047   0.8691   2.3403

Coefficients:
                                  Estimate Std. Error z value Pr(>|z|)
(Intercept)                     -2.674e+01  3.045e+00  -8.782  < 2e-16 ***
age25.29                        -2.365e-01  7.873e-02  -3.004 0.002665 **
age30.35                        -3.103e-01  7.447e-02  -4.167 3.08e-05 ***
age36.40                        -5.035e-01  7.717e-02  -6.525 6.81e-11 ***
age41.45                        -3.892e-01  7.928e-02  -4.910 9.12e-07 ***
age46.50                        -4.797e-01  8.121e-02  -5.907 3.48e-09 ***
age51.55                        -3.295e-01  8.340e-02  -3.951 7.79e-05 ***
age56.60                        -1.740e-01  8.633e-02  -2.015 0.043864 *
ageOver 61                       5.013e-01  1.079e-01   4.646 3.39e-06 ***
monthaug                        -2.372e-01  7.049e-02  -3.365 0.000764 ***
monthdec                         5.376e-01  1.750e-01   3.072 0.002127 **
monthjul                         3.578e-02  6.176e-02   0.579 0.562409
monthjun                        -2.580e-02  6.153e-02  -0.419 0.674972
monthmar                         1.231e+00  1.067e-01  11.544  < 2e-16 ***
monthmay                        -6.345e-01  5.054e-02 -12.556  < 2e-16 ***
monthnov                        -3.624e-01  6.342e-02  -5.714 1.10e-08 ***
monthoct                         6.547e-01  1.035e-01   6.326 2.51e-10 ***
monthsep                         1.133e-01  1.071e-01   1.057 0.290368
poutcomenonexistent              3.905e-01  4.253e-02   9.180  < 2e-16 ***
poutcomesuccess                  1.533e+00  1.190e-01  12.887  < 2e-16 ***
emp.var.rate                    -2.324e-01  1.730e-02 -13.436  < 2e-16 ***
cons.price.idx                   3.133e-01  3.258e-02   9.617  < 2e-16 ***
factor(contact == "telephone")TRUE -4.526e-01  4.358e-02 -10.385  < 2e-16 ***
factor(day_of_week == "wed")TRUE  7.247e-02  3.232e-02   2.243 0.024928 *
campaign                        -4.831e-02  5.749e-03  -8.402  < 2e-16 ***
euribor3m                       -2.368e-01  1.454e-02 -16.288  < 2e-16 ***
educationlow                    -2.798e-01  3.480e-02  -8.042 8.86e-16 ***
educationmed                    -1.466e-01  3.145e-02  -4.661 3.15e-06 ***
educationunknown                -8.250e-02  6.817e-02  -1.210 0.226170
pdays                           -3.932e-04  9.437e-05  -4.166 3.10e-05 ***
cons.conf.idx                    2.848e-02  3.320e-03   8.579  < 2e-16 ***
---
Signif. Codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

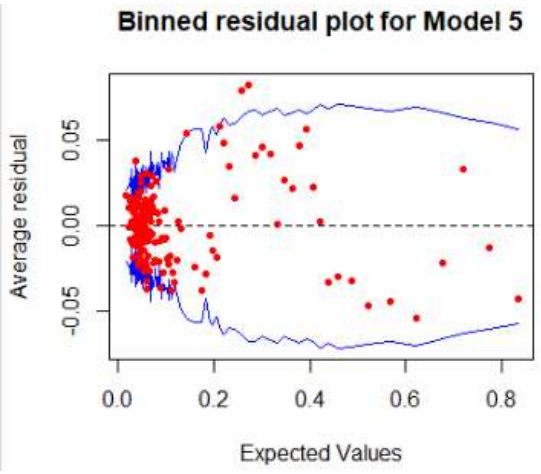
(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 45677  on 32949  degrees of freedom
Residual deviance: 35829  on 32919  degrees of freedom
AIC: 35891

Number of Fisher Scoring iterations: 5
```

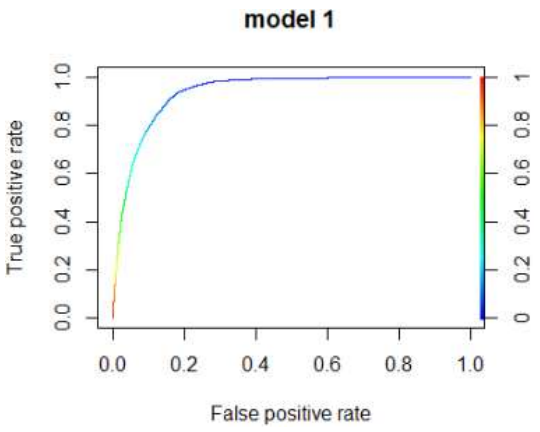
Binned plot for model 5

The binned plot covers most of the data points between its borders.



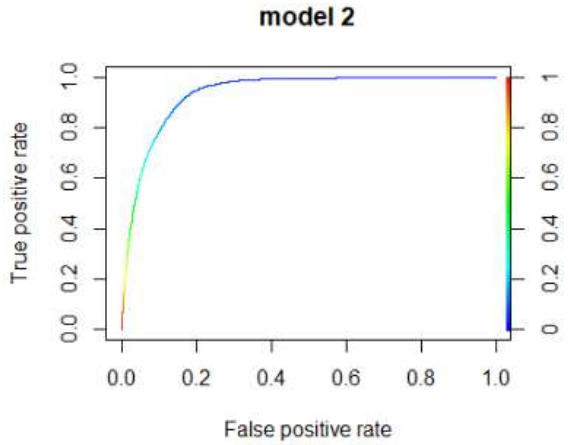
Accuracy : 0.9115326

	FALSE	TRUE
no	24882	682
yes	1866	1401



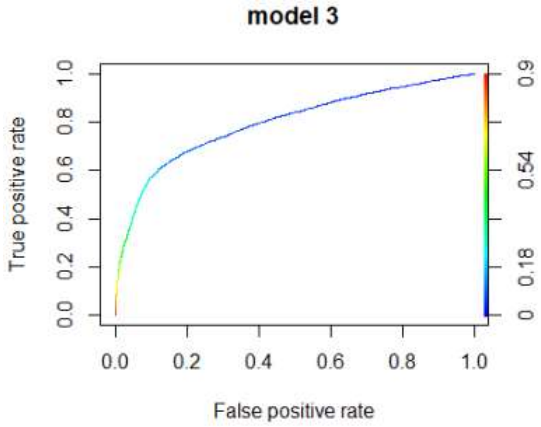
Accuracy : 0.910349

	FALSE	TRUE
no	24877	687
yes	1897	1370



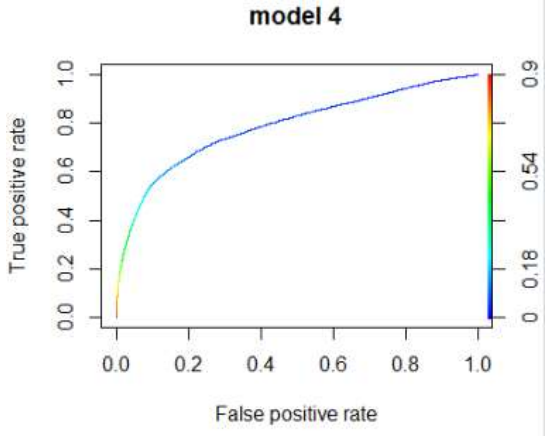
Accuracy : 0.8997524

	FALSE	TRUE
no	25176	388
yes	2538	729



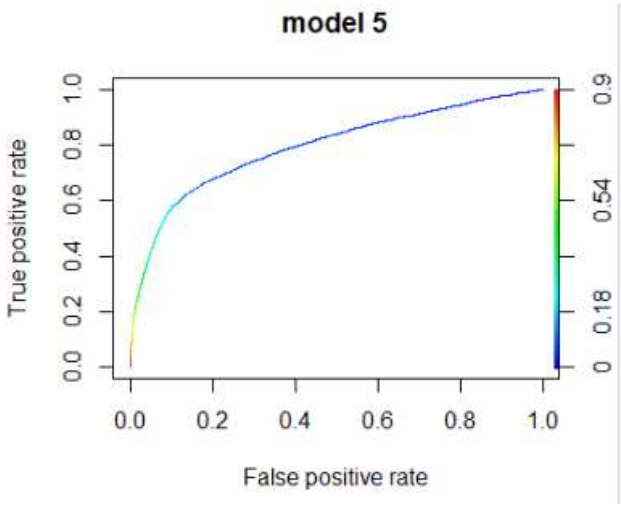
Accuracy : 0.8994125

	FALSE	TRUE
no	25193	371
yes	2574	693



Accuracy : 0.9001651

	FALSE	TRUE
no	25180	384
yes	2533	734



Below is the numbers of most important variables in the model

```
> varImp(data, sort=TRUE)
                  Overall
age25.29          1.73636223
age30.35          2.51360816
age36.40          3.78297047
age41.45          3.78260577
age46.50          3.42667009
age51.55          2.19052148
age56.60          0.95876942
ageOver 61        1.41840963
joblow            1.95004008
jobmed            0.72487648
maritalmarried    0.34485541
maritalsingle     0.09364796
maritalunknown    0.01502692
educationlow      3.68316142
educationmed      2.90935675
educationunknown  0.95698851
defaultunknown    4.22875735
defaultyes        0.06336017
housingunknown    0.66401347
housingyes        0.11277155
loanyes           0.85091738
contacttelephone  8.36654411
monthaug          7.16080554
monthdec          1.42182451
monthjul          1.02846729
monthjun          4.24354181
monthmar          13.70520681
monthmay          5.61781552
monthnov          3.61561357
monthoct          1.10533157
monthsep          1.97833682
day_of_weekmon    1.81810229
day_of_weekthu    0.82452206
day_of_weektue    1.42421502
day_of_weekwed    2.55196201
duration          63.15635876
campaign          3.48770908
pdays             4.44404874
previous          1.07634764
poutcomenonexistent 4.55051442
poutcomesuccess   4.48258557
emp.var.rate      12.37912062
cons.price.idx    8.59150585
cons.conf.idx     2.52422789
euribor3m         2.73505679
nr.employed       1.64177097
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