Models and Predictions for Hit/Miss POD Data

Choose one of the four distributions.

```
Distribution="Log_Log"
#Distribution="Weib_Log"
#Distribution="Weib_Weib"
#Distribution="Unif_Unif"
```

Input the combination(s) of overlap, evenness and sample size (n) at which to predict the percent bias.

```
# Input a vector c(0,1,2) or a value.
  # Overlap should be between 0 and 0.7
  # Evenness should be between 0 and 0.5
  # n is sample size

n        = c(60, 60)
overlap  = c(0.36667, 0.36667)
evenness = c(0.16667, 0.5)
CI = "all" # "LR", "MLR", "Std. Wald", "Mod. Wald"
```

Set folder to the location where the github files are saved.

```
folder = "C:/Users/chriz/GitRepositories/HitMissPaperData/"
```

Predicted Percent Bias in a9095 Estimation (uses Likelihood Ratio for Calculating a9095):

```
## [1] "The Model for Percent Bias in a9095 for Log_Log using a Standard Wald Confidence Interval for a
```

```
##
## Call:
## lm(formula = log(Perc_Bias_pos) ~ (Overlap + Even + Model + N)^4 +
##     poly(Overlap, 11) + poly(Even, 4) + poly(N, 6), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.3823  -0.1581   0.0063   0.1603   2.2525
##
## Coefficients: (3 not defined because of singularities)
##                              Estimate Std. Error  t value Pr(>|t|)
## (Intercept)                 2.885e+00  1.479e-02  195.135  < 2e-16 ***
## Overlap                    -2.744e+00  4.310e-02  -63.678  < 2e-16 ***
## Even                       -6.838e+00  4.197e-02 -162.936  < 2e-16 ***
## ModelLasso                  1.130e-01  2.317e-02    4.879 1.07e-06 ***
## ModelLogit                  4.617e-02  2.419e-02    1.909 0.056295 .
## ModelRSS                    2.948e-01  2.174e-02   13.561  < 2e-16 ***
## N                          -7.406e-03  1.211e-04  -61.146  < 2e-16 ***
## poly(Overlap, 11)1                 NA         NA       NA       NA
## poly(Overlap, 11)2         -9.789e+00  4.311e-01  -22.709  < 2e-16 ***
## poly(Overlap, 11)3          4.419e+00  4.320e-01   10.230  < 2e-16 ***
## poly(Overlap, 11)4          6.620e+01  4.004e-01  165.340  < 2e-16 ***
## poly(Overlap, 11)5         -5.423e+01  3.707e-01 -146.293  < 2e-16 ***
```

```
## poly(Overlap, 11)6         1.413e+01  3.490e-01   40.489  < 2e-16 ***
## poly(Overlap, 11)7        -1.891e+00  3.365e-01   -5.621 1.90e-08 ***
## poly(Overlap, 11)8         3.248e+00  3.300e-01    9.843  < 2e-16 ***
## poly(Overlap, 11)9        -4.397e+00  3.268e-01  -13.456  < 2e-16 ***
## poly(Overlap, 11)10        4.299e+00  3.233e-01   13.299  < 2e-16 ***
## poly(Overlap, 11)11       -1.717e+00  3.216e-01   -5.337 9.47e-08 ***
## poly(Even, 4)1                    NA         NA       NA       NA
## poly(Even, 4)2             7.795e+01  3.224e-01  241.778  < 2e-16 ***
## poly(Even, 4)3             5.722e+00  3.706e-01   15.439  < 2e-16 ***
## poly(Even, 4)4             2.775e+01  3.451e-01   80.402  < 2e-16 ***
## poly(N, 6)1                       NA         NA       NA       NA
## poly(N, 6)2                3.741e+01  3.503e-01  106.792  < 2e-16 ***
## poly(N, 6)3               -1.545e+01  3.309e-01  -46.702  < 2e-16 ***
## poly(N, 6)4                4.902e+00  3.184e-01   15.396  < 2e-16 ***
## poly(N, 6)5               -3.728e+00  3.119e-01  -11.955  < 2e-16 ***
## poly(N, 6)6                1.456e+00  3.087e-01    4.717 2.40e-06 ***
## Overlap:Even               5.700e+00  1.192e-01   47.831  < 2e-16 ***
## Overlap:ModelLasso         1.051e-02  6.571e-02    0.160 0.872863
## Overlap:ModelLogit        -1.509e-01  6.585e-02   -2.292 0.021924 *
## Overlap:ModelRSS          -9.352e-01  5.974e-02  -15.656  < 2e-16 ***
## Overlap:N                  3.981e-03  3.262e-04   12.206  < 2e-16 ***
## Even:ModelLasso            2.577e-01  6.578e-02    3.917 8.95e-05 ***
## Even:ModelLogit            1.421e-01  6.892e-02    2.063 0.039157 *
## Even:ModelRSS             -1.667e-01  6.253e-02   -2.666 0.007666 **
## Even:N                     1.581e-02  3.423e-04   46.185  < 2e-16 ***
## ModelLasso:N               8.123e-04  1.817e-04    4.470 7.82e-06 ***
## ModelLogit:N               6.680e-04  1.867e-04    3.578 0.000347 ***
## ModelRSS:N                -1.265e-03  1.726e-04   -7.325 2.39e-13 ***
## Overlap:Even:ModelLasso   -4.854e-01  1.827e-01   -2.657 0.007879 **
## Overlap:Even:ModelLogit   -6.324e-01  1.834e-01   -3.449 0.000563 ***
## Overlap:Even:ModelRSS     -3.457e-02  1.675e-01   -0.206 0.836485
## Overlap:Even:N            -1.853e-02  8.973e-04  -20.646  < 2e-16 ***
## Overlap:ModelLasso:N      -2.334e-03  4.851e-04   -4.812 1.50e-06 ***
## Overlap:ModelLogit:N      -1.007e-03  4.859e-04   -2.074 0.038112 *
## Overlap:ModelRSS:N         4.350e-03  4.531e-04    9.599  < 2e-16 ***
## Even:ModelLasso:N         -4.588e-03  5.172e-04   -8.871  < 2e-16 ***
## Even:ModelLogit:N         -2.955e-03  5.326e-04   -5.547 2.90e-08 ***
## Even:ModelRSS:N            5.124e-04  4.958e-04    1.034 0.301363
## Overlap:Even:ModelLasso:N  8.558e-03  1.347e-03    6.354 2.10e-10 ***
## Overlap:Even:ModelLogit:N  7.351e-03  1.351e-03    5.441 5.32e-08 ***
## Overlap:Even:ModelRSS:N    1.709e-03  1.269e-03    1.347 0.178076
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3058 on 172781 degrees of freedom
##   (17857 observations deleted due to missingness)
## Multiple R-squared:  0.8429, Adjusted R-squared:  0.8429
## F-statistic: 1.892e+04 on 49 and 172781 DF,  p-value: < 2.2e-16

## [1] "The Model for Percent Bias in a9095 for Log_Log using a Modified Wald Confidence Interval for a

##
## Call:
## lm(formula = log(Perc_Bias_pos) ~ (Overlap + Even + Model + N)^4 +
##     poly(Overlap, 11) + poly(Even, 4) + poly(N, 6), data = data)
```

```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.4937  -0.1549   0.0055   0.1594   2.5545
##
## Coefficients: (3 not defined because of singularities)
##                              Estimate Std. Error  t value Pr(>|t|)
## (Intercept)                 3.064e+00  1.445e-02  211.998  < 2e-16 ***
## Overlap                    -3.010e+00  4.228e-02  -71.198  < 2e-16 ***
## Even                       -7.004e+00  4.095e-02 -171.042  < 2e-16 ***
## ModelLasso                 -9.901e-02  2.255e-02   -4.392 1.13e-05 ***
## ModelLogit                 -2.043e-01  2.359e-02   -8.661  < 2e-16 ***
## ModelRSS                   -4.855e-02  2.126e-02   -2.284 0.022379 *
## N                          -8.567e-03  1.183e-04  -72.409  < 2e-16 ***
## poly(Overlap, 11)1                 NA         NA       NA       NA
## poly(Overlap, 11)2         -8.258e+00  4.240e-01  -19.474  < 2e-16 ***
## poly(Overlap, 11)3          3.081e+00  4.213e-01    7.313 2.63e-13 ***
## poly(Overlap, 11)4          6.602e+01  3.912e-01  168.766  < 2e-16 ***
## poly(Overlap, 11)5         -5.389e+01  3.615e-01 -149.074  < 2e-16 ***
## poly(Overlap, 11)6          1.420e+01  3.402e-01   41.731  < 2e-16 ***
## poly(Overlap, 11)7         -2.892e+00  3.281e-01   -8.814  < 2e-16 ***
## poly(Overlap, 11)8          2.730e+00  3.220e-01    8.477  < 2e-16 ***
## poly(Overlap, 11)9         -4.817e+00  3.189e-01  -15.106  < 2e-16 ***
## poly(Overlap, 11)10         4.210e+00  3.155e-01   13.343  < 2e-16 ***
## poly(Overlap, 11)11        -1.455e+00  3.140e-01   -4.636 3.56e-06 ***
## poly(Even, 4)1                     NA         NA       NA       NA
## poly(Even, 4)2              7.920e+01  3.160e-01  250.626  < 2e-16 ***
## poly(Even, 4)3              5.657e+00  3.651e-01   15.495  < 2e-16 ***
## poly(Even, 4)4              3.939e+01  3.594e-01  109.586  < 2e-16 ***
## poly(N, 6)1                        NA         NA       NA       NA
## poly(N, 6)2                 3.946e+01  3.408e-01  115.774  < 2e-16 ***
## poly(N, 6)3                -1.598e+01  3.235e-01  -49.406  < 2e-16 ***
## poly(N, 6)4                 3.171e+00  3.104e-01   10.215  < 2e-16 ***
## poly(N, 6)5                -1.458e+00  3.048e-01   -4.782 1.74e-06 ***
## poly(N, 6)6                 2.001e+00  3.028e-01    6.610 3.86e-11 ***
## Overlap:Even                5.861e+00  1.171e-01   50.049  < 2e-16 ***
## Overlap:ModelLasso          4.361e-01  6.432e-02    6.780 1.21e-11 ***
## Overlap:ModelLogit          3.482e-01  6.429e-02    5.417 6.08e-08 ***
## Overlap:ModelRSS           -4.323e-01  5.832e-02   -7.413 1.24e-13 ***
## Overlap:N                   6.135e-03  3.188e-04   19.245  < 2e-16 ***
## Even:ModelLasso             4.702e-01  6.405e-02    7.341 2.12e-13 ***
## Even:ModelLogit             4.911e-01  6.719e-02    7.309 2.70e-13 ***
## Even:ModelRSS               4.560e-01  6.109e-02    7.464 8.45e-14 ***
## Even:N                      1.697e-02  3.343e-04   50.754  < 2e-16 ***
## ModelLasso:N                1.960e-03  1.772e-04   11.060  < 2e-16 ***
## ModelLogit:N                2.095e-03  1.823e-04   11.491  < 2e-16 ***
## ModelRSS:N                  7.350e-04  1.686e-04    4.361 1.30e-05 ***
## Overlap:Even:ModelLasso    -1.089e+00  1.795e-01   -6.069 1.29e-09 ***
## Overlap:Even:ModelLogit    -1.344e+00  1.792e-01   -7.496 6.62e-14 ***
## Overlap:Even:ModelRSS      -5.992e-01  1.634e-01   -3.666 0.000246 ***
## Overlap:Even:N             -2.058e-02  8.790e-04  -23.418  < 2e-16 ***
## Overlap:ModelLasso:N       -4.648e-03  4.742e-04   -9.802  < 2e-16 ***
## Overlap:ModelLogit:N       -3.876e-03  4.741e-04   -8.174 2.99e-16 ***
## Overlap:ModelRSS:N          8.542e-04  4.402e-04    1.940 0.052328 .
```

```
## Even:ModelLasso:N         -5.700e-03  5.045e-04  -11.297  < 2e-16 ***
## Even:ModelLogit:N         -5.017e-03  5.201e-04   -9.645  < 2e-16 ***
## Even:ModelRSS:N           -2.874e-03  4.834e-04   -5.944 2.79e-09 ***
## Overlap:Even:ModelLasso:N  1.181e-02  1.320e-03    8.948  < 2e-16 ***
## Overlap:Even:ModelLogit:N  1.160e-02  1.320e-03    8.786  < 2e-16 ***
## Overlap:Even:ModelRSS:N    5.595e-03  1.230e-03    4.550 5.38e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2994 on 173921 degrees of freedom
##   (16868 observations deleted due to missingness)
## Multiple R-squared:  0.8514, Adjusted R-squared:  0.8514
## F-statistic: 2.034e+04 on 49 and 173921 DF,  p-value: < 2.2e-16
```

```
## [1] "The Model for Percent Bias in a9095 for Log_Log using a Likelihood Ratio Confidence Interval fo
```

```
##
## Call:
## lm(formula = log(Perc_Bias_pos) ~ (Overlap + Even + Model + N)^4 +
##     poly(Overlap, 12) + poly(Even, 4) + poly(N, 6), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.0899  -0.1582   0.0051   0.1632   1.7869
##
## Coefficients: (3 not defined because of singularities)
##                             Estimate Std. Error  t value Pr(>|t|)
## (Intercept)                2.646e+00  1.617e-02  163.635  < 2e-16 ***
## Overlap                   -2.543e+00  4.431e-02  -57.393  < 2e-16 ***
## Even                      -5.444e+00  4.756e-02 -114.471  < 2e-16 ***
## ModelLasso                -1.739e-01  2.161e-02   -8.045 8.66e-16 ***
## ModelLogit                -6.477e-02  2.161e-02   -2.997 0.002729 **
## ModelRSS                  -4.135e-01  2.249e-02  -18.389  < 2e-16 ***
## N                         -5.573e-03  1.266e-04  -44.017  < 2e-16 ***
## poly(Overlap, 12)1                NA         NA       NA       NA
## poly(Overlap, 12)2         2.913e+01  4.024e-01   72.379  < 2e-16 ***
## poly(Overlap, 12)3        -4.736e+01  4.012e-01 -118.057  < 2e-16 ***
## poly(Overlap, 12)4         1.089e+02  3.750e-01  290.457  < 2e-16 ***
## poly(Overlap, 12)5        -8.637e+01  3.495e-01 -247.128  < 2e-16 ***
## poly(Overlap, 12)6         3.790e+01  3.316e-01  114.274  < 2e-16 ***
## poly(Overlap, 12)7        -1.997e+01  3.209e-01  -62.225  < 2e-16 ***
## poly(Overlap, 12)8         1.575e+01  3.155e-01   49.932  < 2e-16 ***
## poly(Overlap, 12)9        -1.460e+01  3.130e-01  -46.629  < 2e-16 ***
## poly(Overlap, 12)10        1.132e+01  3.101e-01   36.491  < 2e-16 ***
## poly(Overlap, 12)11       -6.561e+00  3.085e-01  -21.267  < 2e-16 ***
## poly(Overlap, 12)12        4.830e+00  3.070e-01   15.732  < 2e-16 ***
## poly(Even, 4)1                    NA         NA       NA       NA
## poly(Even, 4)2             7.334e+01  3.127e-01  234.527  < 2e-16 ***
## poly(Even, 4)3             1.309e+00  3.563e-01    3.675 0.000238 ***
## poly(Even, 4)4             3.676e+01  3.529e-01  104.164  < 2e-16 ***
## poly(N, 6)1                       NA         NA       NA       NA
## poly(N, 6)2                1.997e+01  3.256e-01   61.318  < 2e-16 ***
## poly(N, 6)3               -9.044e+00  3.168e-01  -28.552  < 2e-16 ***
## poly(N, 6)4                7.945e-01  3.090e-01    2.571 0.010129 *
## poly(N, 6)5               -1.106e+00  3.056e-01   -3.619 0.000296 ***
```

```
## poly(N, 6)6                1.961e+00  3.045e-01    6.441 1.19e-10 ***
## Overlap:Even               3.233e+00  1.262e-01   25.628  < 2e-16 ***
## Overlap:ModelLasso        -2.355e-01  5.876e-02   -4.007 6.15e-05 ***
## Overlap:ModelLogit        -4.278e-01  5.875e-02   -7.282 3.30e-13 ***
## Overlap:ModelRSS          -1.267e-01  5.991e-02   -2.114 0.034491 *
## Overlap:N                  1.738e-03  3.294e-04    5.276 1.32e-07 ***
## Even:ModelLasso           -7.188e-01  6.478e-02  -11.096  < 2e-16 ***
## Even:ModelLogit           -9.313e-01  6.478e-02  -14.377  < 2e-16 ***
## Even:ModelRSS             -2.288e-01  6.588e-02   -3.473 0.000516 ***
## Even:N                     9.940e-03  3.682e-04   26.998  < 2e-16 ***
## ModelLasso:N               1.084e-03  1.725e-04    6.283 3.33e-10 ***
## ModelLogit:N               6.781e-04  1.725e-04    3.930 8.49e-05 ***
## ModelRSS:N                 2.534e-03  1.752e-04   14.463  < 2e-16 ***
## Overlap:Even:ModelLasso    1.995e+00  1.704e-01   11.710  < 2e-16 ***
## Overlap:Even:ModelLogit    2.372e+00  1.703e-01   13.923  < 2e-16 ***
## Overlap:Even:ModelRSS      1.397e+00  1.705e-01    8.196 2.51e-16 ***
## Overlap:Even:N            -6.558e-03  9.299e-04   -7.052 1.77e-12 ***
## Overlap:ModelLasso:N       1.694e-03  4.458e-04    3.800 0.000145 ***
## Overlap:ModelLogit:N       2.554e-03  4.458e-04    5.728 1.02e-08 ***
## Overlap:ModelRSS:N         5.043e-04  4.499e-04    1.121 0.262299
## Even:ModelLasso:N          3.677e-03  5.091e-04    7.223 5.10e-13 ***
## Even:ModelLogit:N          4.511e-03  5.091e-04    8.861  < 2e-16 ***
## Even:ModelRSS:N            1.445e-03  5.093e-04    2.838 0.004545 **
## Overlap:Even:ModelLasso:N -1.074e-02  1.277e-03   -8.411  < 2e-16 ***
## Overlap:Even:ModelLogit:N -1.241e-02  1.277e-03   -9.723  < 2e-16 ***
## Overlap:Even:ModelRSS:N   -6.873e-03  1.271e-03   -5.406 6.44e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3019 on 180117 degrees of freedom
##   (10671 observations deleted due to missingness)
## Multiple R-squared:  0.8364, Adjusted R-squared:  0.8364
## F-statistic: 1.842e+04 on 50 and 180117 DF,  p-value: < 2.2e-16

## [1] "The Model for Percent Bias in a9095 for Log_Log using a Modified Likelihood Ratio Confidence In

##
## Call:
## lm(formula = log(Perc_Bias_pos) ~ (Overlap + Even + Model + N)^4 +
##     poly(Overlap, 10) + poly(Even, 4) + poly(N, 6), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.0478  -0.1484   0.0075   0.1558   2.5891
##
## Coefficients: (3 not defined because of singularities)
##                             Estimate Std. Error  t value Pr(>|t|)
## (Intercept)                2.031e+00  1.680e-02  120.879  < 2e-16 ***
## Overlap                   -1.308e+00  4.455e-02  -29.359  < 2e-16 ***
## Even                      -5.001e+00  4.785e-02 -104.512  < 2e-16 ***
## ModelLasso                 2.191e-01  2.147e-02   10.207  < 2e-16 ***
## ModelLogit                 3.305e-01  2.146e-02   15.400  < 2e-16 ***
## ModelRSS                   2.909e-01  2.243e-02   12.972  < 2e-16 ***
## N                         -3.237e-03  1.273e-04  -25.440  < 2e-16 ***
## poly(Overlap, 10)1                NA         NA       NA       NA
```

```
## poly(Overlap, 10)2        -3.450e+01  3.591e-01  -96.086  < 2e-16 ***
## poly(Overlap, 10)3         2.174e+01  3.560e-01   61.081  < 2e-16 ***
## poly(Overlap, 10)4         5.084e+01  3.387e-01  150.077  < 2e-16 ***
## poly(Overlap, 10)5        -4.301e+01  3.216e-01 -133.747  < 2e-16 ***
## poly(Overlap, 10)6         7.373e+00  3.105e-01   23.745  < 2e-16 ***
## poly(Overlap, 10)7         1.448e+00  3.043e-01    4.758 1.95e-06 ***
## poly(Overlap, 10)8         2.780e-01  3.017e-01    0.921   0.3568
## poly(Overlap, 10)9        -3.366e+00  3.004e-01  -11.202  < 2e-16 ***
## poly(Overlap, 10)10        2.429e+00  2.988e-01    8.131 4.28e-16 ***
## poly(Even, 4)1                    NA         NA       NA       NA
## poly(Even, 4)2             7.508e+01  2.986e-01  251.438  < 2e-16 ***
## poly(Even, 4)3             2.600e+00  3.394e-01    7.662 1.84e-14 ***
## poly(Even, 4)4             3.742e+01  3.369e-01  111.084  < 2e-16 ***
## poly(N, 6)1                       NA         NA       NA       NA
## poly(N, 6)2                1.437e+01  3.112e-01   46.165  < 2e-16 ***
## poly(N, 6)3               -4.903e+00  3.019e-01  -16.238  < 2e-16 ***
## poly(N, 6)4               -5.328e-01  2.944e-01   -1.810   0.0703 .
## poly(N, 6)5               -5.549e-01  2.913e-01   -1.905   0.0568 .
## poly(N, 6)6                1.963e+00  2.903e-01    6.762 1.36e-11 ***
## Overlap:Even               2.125e+00  1.246e-01   17.054  < 2e-16 ***
## Overlap:ModelLasso        -8.063e-01  5.768e-02  -13.978  < 2e-16 ***
## Overlap:ModelLogit        -1.005e+00  5.765e-02  -17.424  < 2e-16 ***
## Overlap:ModelRSS          -1.417e+00  5.878e-02  -24.106  < 2e-16 ***
## Overlap:N                 -2.806e-03  3.251e-04   -8.630  < 2e-16 ***
## Even:ModelLasso           -1.293e+00  6.106e-02  -21.172  < 2e-16 ***
## Even:ModelLogit           -1.511e+00  6.102e-02  -24.757  < 2e-16 ***
## Even:ModelRSS             -7.326e-01  6.461e-02  -11.339  < 2e-16 ***
## Even:N                     6.491e-03  3.635e-04   17.859  < 2e-16 ***
## ModelLasso:N              -9.923e-04  1.686e-04   -5.884 4.00e-09 ***
## ModelLogit:N              -1.391e-03  1.686e-04   -8.248  < 2e-16 ***
## ModelRSS:N                -1.456e-03  1.719e-04   -8.472  < 2e-16 ***
## Overlap:Even:ModelLasso    3.293e+00  1.615e-01   20.396  < 2e-16 ***
## Overlap:Even:ModelLogit    3.708e+00  1.614e-01   22.977  < 2e-16 ***
## Overlap:Even:ModelRSS      2.669e+00  1.656e-01   16.122  < 2e-16 ***
## Overlap:Even:N             2.092e-03  9.082e-04    2.303   0.0213 *
## Overlap:ModelLasso:N       4.243e-03  4.333e-04    9.792  < 2e-16 ***
## Overlap:ModelLogit:N       5.121e-03  4.332e-04   11.821  < 2e-16 ***
## Overlap:ModelRSS:N         7.476e-03  4.372e-04   17.101  < 2e-16 ***
## Even:ModelLasso:N          6.812e-03  4.811e-04   14.161  < 2e-16 ***
## Even:ModelLogit:N          7.626e-03  4.809e-04   15.858  < 2e-16 ***
## Even:ModelRSS:N            4.545e-03  4.943e-04    9.194  < 2e-16 ***
## Overlap:Even:ModelLasso:N -1.795e-02  1.210e-03  -14.831  < 2e-16 ***
## Overlap:Even:ModelLogit:N -1.981e-02  1.210e-03  -16.369  < 2e-16 ***
## Overlap:Even:ModelRSS:N   -1.460e-02  1.227e-03  -11.902  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2874 on 179511 degrees of freedom
##   (11279 observations deleted due to missingness)
## Multiple R-squared:  0.8244, Adjusted R-squared:  0.8244
## F-statistic: 1.756e+04 on 48 and 179511 DF,  p-value: < 2.2e-16
```

```
##    Distribution Overlap    Even Model  N percent.bias low.confidence
## 1       Log_Log 0.36667 0.16667 Logit 60  1.990383566    1.968033401
```

```
## 2       Log_Log 0.36667 0.50000 Logit 60 -0.053090411   -0.058618416
## 3       Log_Log 0.36667 0.16667 Firth 60  2.381184522    2.354905320
## 4       Log_Log 0.36667 0.50000 Firth 60  0.057346580    0.050789319
## 5       Log_Log 0.36667 0.16667 Lasso 60  1.929360359    1.907510387
## 6       Log_Log 0.36667 0.50000 Lasso 60 -0.054724799   -0.060240817
## 7       Log_Log 0.36667 0.16667   RSS 60  1.674221589    1.654693832
## 8       Log_Log 0.36667 0.50000   RSS 60 -0.072611362   -0.078214390
## 9       Log_Log 0.36667 0.16667 Logit 60  2.145198316    2.123017857
## 10      Log_Log 0.36667 0.50000 Logit 60 -0.020747452   -0.026075266
## 11      Log_Log 0.36667 0.16667 Firth 60  2.232242468    2.208775700
## 12      Log_Log 0.36667 0.50000 Firth 60  0.030668372    0.024806548
## 13      Log_Log 0.36667 0.16667 Lasso 60  2.076564116    2.054914157
## 14      Log_Log 0.36667 0.50000 Lasso 60 -0.024212088   -0.029512266
## 15      Log_Log 0.36667 0.16667   RSS 60  1.904625400    1.884789060
## 16      Log_Log 0.36667 0.50000   RSS 60 -0.006714544   -0.012430656
## 17      Log_Log 0.36667 0.16667 Logit 60  2.358320650    2.332393569
## 18      Log_Log 0.36667 0.50000 Logit 60  0.013154019    0.007458894
## 19      Log_Log 0.36667 0.16667 Firth 60  2.384750884    2.358398305
## 20      Log_Log 0.36667 0.50000 Firth 60  0.042073492    0.036178054
## 21      Log_Log 0.36667 0.16667 Lasso 60  2.745751988    2.715414636
## 22      Log_Log 0.36667 0.50000 Lasso 60  0.120827028    0.114004033
## 23      Log_Log 0.36667 0.16667   RSS 60  2.246676762    2.223078415
## 24      Log_Log 0.36667 0.50000   RSS 60 -0.012101880   -0.017674990
## 25      Log_Log 0.36667 0.16667 Logit 60  2.533243284    2.506281697
## 26      Log_Log 0.36667 0.50000 Logit 60  0.022120242    0.016479635
## 27      Log_Log 0.36667 0.16667 Firth 60  2.675903529    2.647448480
## 28      Log_Log 0.36667 0.50000 Firth 60  0.062587983    0.056618625
## 29      Log_Log 0.36667 0.16667 Lasso 60  2.931309484    2.899838304
## 30      Log_Log 0.36667 0.50000 Lasso 60  0.113494359    0.106876424
## 31      Log_Log 0.36667 0.16667   RSS 60  2.322275246    2.298427414
## 32      Log_Log 0.36667 0.50000   RSS 60  0.028172393    0.022374519
##    up.confidence low.pred.interval up.pred.interval Overlap_P  Even_P        CI
## 1   2.0129207166         0.7872131        4.1646717   36.667% 16.667%        LR
## 2  -0.0475150153        -0.3435707        0.4718473   36.667%     50%        LR
## 3   2.4076895300         1.0034624        4.8709185   36.667% 16.667%        LR
## 4   0.0639608486        -0.2824598        0.6714246   36.667%     50%        LR
## 5   1.9513931830         0.7534451        4.0543948   36.667% 16.667%        LR
## 6  -0.0491614773        -0.3444751        0.4688938   36.667%     50%        LR
## 7   1.6939110550         0.6122624        3.5933201   36.667% 16.667%        LR
## 8  -0.0669581227        -0.3543748        0.4365768   36.667%     50%        LR
## 9   2.1675532157         0.9210486        4.2953307   36.667% 16.667%       MLR
## 10 -0.0153773471        -0.3121046        0.4910012   36.667%     50%       MLR
## 11  2.2558987344         0.9706012        4.4482327   36.667% 16.667%       MLR
## 12  0.0365777810        -0.2828327        0.5813128   36.667%     50%       MLR
## 13  2.0983843838         0.8819726        4.1747797   36.667% 16.667%       MLR
## 14 -0.0188698420        -0.3140771        0.4849158   36.667%     50%       MLR
## 15  1.9246141304         0.7840853        3.8727700   36.667% 16.667%       MLR
## 16 -0.0009507225        -0.3041174        0.5156561   36.667%     50%       MLR
## 17  2.3844745512         1.0103430        4.8131715   36.667% 16.667% Std. Wald
## 18  0.0188999242        -0.2774071        0.5423067   36.667%     50% Std. Wald
## 19  2.4113357505         1.0248545        4.8613098   36.667% 16.667% Std. Wald
## 20  0.0480210054        -0.2615268        0.5949716   36.667%     50% Std. Wald
## 21  2.7763643451         1.2230759        5.5187652   36.667% 16.667% Std. Wald
## 22  0.1277124874        -0.2182846        0.7383992   36.667%     50% Std. Wald
```

```
## 23  2.2704702100         0.9490491        4.6098174   36.667% 16.667% Std. Wald
## 24 -0.0064781498        -0.2912761        0.4963149   36.667%     50% Std. Wald
## 25  2.5604363674         1.1272893        5.0616090   36.667% 16.667% Mod. Wald
## 26  0.0278097739        -0.2690769        0.5457888   36.667%     50% Mod. Wald
## 27  2.7046053374         1.2066164        5.3181662   36.667% 16.667% Mod. Wald
## 28  0.0686089494        -0.2465738        0.6185626   36.667%     50% Mod. Wald
## 29  2.9630609481         1.3486336        5.7774925   36.667% 16.667% Mod. Wald
## 30  0.1201714220        -0.2182680        0.7101148   36.667%     50% Mod. Wald
## 31  2.3463170293         1.0099863        4.6821854   36.667% 16.667% Mod. Wald
## 32  0.0340214940        -0.2657124        0.5566754   36.667%     50% Mod. Wald
```

Predict Probability of a9095 not existing (uses Likelihood Ratio for Calculating a9095):

```
## [1] "The Model for probability of a9095 not existing when using a standard Wald  confidence interval
```

```
##
## Call:
## glm(formula = !a9095Exist ~ (Overlap + Even + N + Model)^4 +
##     poly(Overlap, 5) + poly(Even, 2) + poly(N, 5), family = binomial(),
##     data = Wald_DATA_old)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.7390  -0.0979  -0.0201  -0.0006   4.4059
##
## Coefficients: (3 not defined because of singularities)
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                   1.32321    1.20460   1.098 0.271999
## Overlap                      14.28987    1.95799   7.298 2.92e-13 ***
## Even                        -14.59380    2.68300  -5.439 5.35e-08 ***
## N                            -0.21249    0.03909  -5.436 5.45e-08 ***
## ModelLasso                   -2.07092    1.21507  -1.704 0.088314 .
## ModelLogit                   -0.21713    1.21208  -0.179 0.857828
## ModelRSS                     -3.96278    1.21182  -3.270 0.001075 **
## poly(Overlap, 5)1                  NA         NA      NA       NA
## poly(Overlap, 5)2           770.75883    8.57128  89.923  < 2e-16 ***
## poly(Overlap, 5)3          -317.48864    8.07786 -39.304  < 2e-16 ***
## poly(Overlap, 5)4           174.14825    6.42678  27.097  < 2e-16 ***
## poly(Overlap, 5)5           -16.86335    6.33940  -2.660 0.007812 **
## poly(Even, 2)1                     NA         NA      NA       NA
## poly(Even, 2)2              226.17951    6.78055  33.357  < 2e-16 ***
## poly(N, 5)1                        NA         NA      NA       NA
## poly(N, 5)2                -115.58886   49.31861  -2.344 0.019093 *
## poly(N, 5)3                -498.91012   37.90073 -13.164  < 2e-16 ***
## poly(N, 5)4                -350.51542   24.40228 -14.364  < 2e-16 ***
## poly(N, 5)5                -289.40878   13.92773 -20.779  < 2e-16 ***
## Overlap:Even                  9.06224    4.50453   2.012 0.044241 *
## Overlap:N                    -0.02142    0.06082  -0.352 0.724688
## Overlap:ModelLasso            3.29157    2.13716   1.540 0.123522
## Overlap:ModelLogit           -9.27527    2.08741  -4.443 8.85e-06 ***
## Overlap:ModelRSS            -14.52668    2.04389  -7.107 1.18e-12 ***
## Even:N                        0.32188    0.08689   3.704 0.000212 ***
## Even:ModelLasso              11.49120    2.75746   4.167 3.08e-05 ***
## Even:ModelLogit              13.67079    2.74239   4.985 6.20e-07 ***
## Even:ModelRSS                15.40382    2.75776   5.586 2.33e-08 ***
```

```
## N:ModelLasso                 0.16869    0.03919   4.304 1.68e-05 ***
## N:ModelLogit                 0.16314    0.03915   4.167 3.09e-05 ***
## N:ModelRSS                   0.17991    0.03913   4.597 4.28e-06 ***
## Overlap:Even:N              -0.24029    0.13657  -1.759 0.078504 .
## Overlap:Even:ModelLasso    -20.75893    5.03710  -4.121 3.77e-05 ***
## Overlap:Even:ModelLogit    -15.08288    4.87556  -3.094 0.001978 **
## Overlap:Even:ModelRSS      -18.91818    4.87089  -3.884 0.000103 ***
## Overlap:N:ModelLasso        -0.26346    0.06269  -4.202 2.64e-05 ***
## Overlap:N:ModelLogit        -0.12427    0.06282  -1.978 0.047916 *
## Overlap:N:ModelRSS           0.03162    0.06106   0.518 0.604540
## Even:N:ModelLasso           -0.29646    0.08742  -3.391 0.000696 ***
## Even:N:ModelLogit           -0.31413    0.08726  -3.600 0.000318 ***
## Even:N:ModelRSS             -0.33002    0.08727  -3.782 0.000156 ***
## Overlap:Even:N:ModelLasso    0.55999    0.14188   3.947 7.91e-05 ***
## Overlap:Even:N:ModelLogit    0.41367    0.14177   2.918 0.003524 **
## Overlap:Even:N:ModelRSS      0.34330    0.13757   2.495 0.012581 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 118566  on 190687  degrees of freedom
## Residual deviance:  34838  on 190647  degrees of freedom
## AIC: 34920
##
## Number of Fisher Scoring iterations: 13

## [1] "The Model for probability of a9095 not existing when using a modified Wald     confidence inter

##
## Call:
## glm(formula = !a9095Exist ~ (Overlap + Even + N + Model)^4 +
##     poly(Overlap, 4) + poly(Even, 5) + poly(N, 4), family = binomial(),
##     data = Wald_DATA)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.7625  -0.0729  -0.0111  -0.0005   4.7270
##
## Coefficients: (3 not defined because of singularities)
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -3.330e+00  4.178e-01  -7.969 1.60e-15 ***
## Overlap                    2.084e+01  8.997e-01  23.168  < 2e-16 ***
## Even                      -9.527e+00  9.616e-01  -9.907  < 2e-16 ***
## N                         -6.562e-02  9.645e-03  -6.803 1.02e-11 ***
## ModelLasso                 2.244e+00  4.240e-01   5.293 1.20e-07 ***
## ModelLogit                 4.250e+00  4.147e-01  10.249  < 2e-16 ***
## ModelRSS                   6.551e-01  4.200e-01   1.560 0.118769
## poly(Overlap, 4)1                 NA         NA      NA       NA
## poly(Overlap, 4)2          8.299e+02  9.277e+00  89.454  < 2e-16 ***
## poly(Overlap, 4)3         -3.408e+02  8.165e+00 -41.732  < 2e-16 ***
## poly(Overlap, 4)4          1.368e+02  6.887e+00  19.864  < 2e-16 ***
## poly(Even, 5)1                    NA         NA      NA       NA
## poly(Even, 5)2             2.490e+02  7.550e+00  32.977  < 2e-16 ***
## poly(Even, 5)3             1.719e+01  5.840e+00   2.943 0.003250 **
```

```
## poly(Even, 5)4           -6.403e+01  6.927e+00  -9.244  < 2e-16 ***
## poly(Even, 5)5            4.089e+01  6.401e+00   6.388 1.68e-10 ***
## poly(N, 4)1                      NA         NA      NA       NA
## poly(N, 4)2               1.408e+02  6.818e+01   2.065 0.038941 *
## poly(N, 4)3              -7.436e+01  4.592e+01  -1.619 0.105377
## poly(N, 4)4               1.166e+02  2.163e+01   5.388 7.12e-08 ***
## Overlap:Even             -4.834e+00  2.311e+00  -2.091 0.036496 *
## Overlap:N                -2.478e-01  1.981e-02 -12.507  < 2e-16 ***
## Overlap:ModelLasso       -1.987e+00  1.243e+00  -1.599 0.109886
## Overlap:ModelLogit       -1.653e+01  1.139e+00 -14.508  < 2e-16 ***
## Overlap:ModelRSS         -2.836e+01  1.889e+00 -15.016  < 2e-16 ***
## Even:N                    1.128e-01  2.473e-02   4.562 5.07e-06 ***
## Even:ModelLasso           4.969e+00  1.174e+00   4.234 2.29e-05 ***
## Even:ModelLogit           7.525e+00  1.139e+00   6.607 3.92e-11 ***
## Even:ModelRSS             6.953e+00  1.202e+00   5.783 7.32e-09 ***
## N:ModelLasso              2.378e-02  9.896e-03   2.403 0.016241 *
## N:ModelLogit              1.709e-02  9.694e-03   1.763 0.077916 .
## N:ModelRSS                3.210e-02  9.743e-03   3.295 0.000985 ***
## Overlap:Even:N            2.261e-01  5.019e-02   4.504 6.66e-06 ***
## Overlap:Even:ModelLasso  -1.067e+01  3.168e+00  -3.369 0.000755 ***
## Overlap:Even:ModelLogit  -1.977e+00  2.918e+00  -0.677 0.498100
## Overlap:Even:ModelRSS     4.541e+01  9.105e+00   4.988 6.11e-07 ***
## Overlap:N:ModelLasso     -6.580e-02  2.494e-02  -2.638 0.008341 **
## Overlap:N:ModelLogit      1.116e-01  2.447e-02   4.561 5.09e-06 ***
## Overlap:N:ModelRSS        5.026e-01  5.417e-02   9.278  < 2e-16 ***
## Even:N:ModelLasso        -7.121e-02  2.683e-02  -2.654 0.007956 **
## Even:N:ModelLogit        -9.380e-02  2.627e-02  -3.570 0.000357 ***
## Even:N:ModelRSS          -6.560e-02  2.694e-02  -2.435 0.014901 *
## Overlap:Even:N:ModelLasso  2.019e-01  6.192e-02   3.261 0.001109 **
## Overlap:Even:N:ModelLogit -2.070e-02  6.068e-02  -0.341 0.732958
## Overlap:Even:N:ModelRSS   -1.757e+00  2.863e-01  -6.138 8.34e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 114043  on 190838  degrees of freedom
## Residual deviance:  31640  on 190797  degrees of freedom
## AIC: 31724
##
## Number of Fisher Scoring iterations: 14

## [1] "The Model for probability of a9095 not existing when using a Likelihood Ratio   confidence inte

##
## Call:
## glm(formula = !a9095Exist ~ (Overlap + Even + N + Model)^4 +
##     poly(Overlap, 9) + poly(Even, 2) + poly(N, 2), family = binomial(),
##     data = LR_DATA)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.9487  -0.0436  -0.0057  -0.0004   5.2345
##
## Coefficients: (3 not defined because of singularities)
```

```
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -6.798e+00  4.155e-01 -16.362  < 2e-16 ***
## Overlap                     2.361e+01  9.483e-01  24.895  < 2e-16 ***
## Even                        6.179e+00  9.650e-01   6.404 1.52e-10 ***
## N                          -1.364e-02  5.832e-03  -2.340 0.019293 *
## ModelLasso                 -6.783e+00  3.973e-01 -17.072  < 2e-16 ***
## ModelLogit                 -6.633e+00  3.950e-01 -16.795  < 2e-16 ***
## ModelRSS                    3.175e+00  4.241e-01   7.485 7.14e-14 ***
## poly(Overlap, 9)1                  NA         NA      NA       NA
## poly(Overlap, 9)2           1.058e+03  3.744e+01  28.267  < 2e-16 ***
## poly(Overlap, 9)3          -6.969e+02  4.361e+01 -15.980  < 2e-16 ***
## poly(Overlap, 9)4           9.076e+01  2.359e+01   3.847 0.000120 ***
## poly(Overlap, 9)5           1.871e+02  3.727e+01   5.019 5.19e-07 ***
## poly(Overlap, 9)6          -3.056e+01  2.725e+01  -1.121 0.262111
## poly(Overlap, 9)7          -1.492e+02  2.044e+01  -7.300 2.88e-13 ***
## poly(Overlap, 9)8           1.818e+02  1.803e+01  10.084  < 2e-16 ***
## poly(Overlap, 9)9          -8.391e+01  1.406e+01  -5.967 2.41e-09 ***
## poly(Even, 2)1                     NA         NA      NA       NA
## poly(Even, 2)2              2.246e+02  8.555e+00  26.249  < 2e-16 ***
## poly(N, 2)1                        NA         NA      NA       NA
## poly(N, 2)2                -1.425e+02  3.128e+01  -4.555 5.24e-06 ***
## Overlap:Even               -2.080e+01  2.506e+00  -8.299  < 2e-16 ***
## Overlap:N                  -3.359e-01  1.986e-02 -16.908  < 2e-16 ***
## Overlap:ModelLasso          2.239e+00  1.217e+00   1.839 0.065922 .
## Overlap:ModelLogit          1.764e+00  1.210e+00   1.458 0.144912
## Overlap:ModelRSS           -2.183e+01  1.521e+00 -14.353  < 2e-16 ***
## Even:N                     -4.851e-02  1.610e-02  -3.013 0.002589 **
## Even:ModelLasso             1.218e+01  1.284e+00   9.491  < 2e-16 ***
## Even:ModelLogit             1.164e+01  1.276e+00   9.117  < 2e-16 ***
## Even:ModelRSS              -8.721e+00  1.290e+00  -6.760 1.38e-11 ***
## N:ModelLasso                5.821e-02  7.053e-03   8.252  < 2e-16 ***
## N:ModelLogit                5.671e-02  7.016e-03   8.082 6.36e-16 ***
## N:ModelRSS                 -3.138e-02  6.990e-03  -4.489 7.16e-06 ***
## Overlap:Even:N              3.379e-01  5.129e-02   6.589 4.42e-11 ***
## Overlap:Even:ModelLasso    -1.139e+01  3.358e+00  -3.392 0.000694 ***
## Overlap:Even:ModelLogit    -9.872e+00  3.346e+00  -2.950 0.003176 **
## Overlap:Even:ModelRSS       3.264e+01  5.872e+00   5.558 2.73e-08 ***
## Overlap:N:ModelLasso        1.843e-02  2.899e-02   0.636 0.525016
## Overlap:N:ModelLogit        2.773e-02  2.873e-02   0.965 0.334387
## Overlap:N:ModelRSS          3.906e-01  3.783e-02  10.325  < 2e-16 ***
## Even:N:ModelLasso          -1.040e-01  2.163e-02  -4.807 1.53e-06 ***
## Even:N:ModelLogit          -9.524e-02  2.150e-02  -4.431 9.39e-06 ***
## Even:N:ModelRSS             7.720e-02  2.071e-02   3.727 0.000194 ***
## Overlap:Even:N:ModelLasso   1.049e-01  7.208e-02   1.455 0.145654
## Overlap:Even:N:ModelLogit   7.182e-02  7.171e-02   1.002 0.316513
## Overlap:Even:N:ModelRSS    -8.201e-01  1.634e-01  -5.019 5.20e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 82282  on 190838  degrees of freedom
## Residual deviance: 21440  on 190797  degrees of freedom
## AIC: 21524
```

```
##
## Number of Fisher Scoring iterations: 13
```

```
## [1] "The Model for probability of a9095 not existing when using a Modified Likelihood Ratio confiden
```

```
##
## Call:
## glm(formula = !a9095Exist ~ (Overlap + Even + N + Model)^4 +
##     poly(Overlap, 7) + poly(Even, 2), family = binomial(), data = MLR_DATA)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.5345  -0.0927  -0.0136  -0.0007   6.3349
##
## Coefficients: (2 not defined because of singularities)
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -7.164e-01  1.944e-01  -3.685 0.000228 ***
## Overlap                     9.317e+00  6.961e-01  13.384  < 2e-16 ***
## Even                       -2.553e+00  5.596e-01  -4.563 5.05e-06 ***
## N                          -2.661e-02  2.972e-03  -8.954  < 2e-16 ***
## ModelLasso                 -4.016e+00  2.651e-01 -15.147  < 2e-16 ***
## ModelLogit                 -3.967e+00  2.655e-01 -14.939  < 2e-16 ***
## ModelRSS                   -9.201e-01  2.793e-01  -3.295 0.000985 ***
## poly(Overlap, 7)1                  NA         NA      NA       NA
## poly(Overlap, 7)2           8.338e+02  1.538e+01  54.228  < 2e-16 ***
## poly(Overlap, 7)3          -2.651e+02  1.109e+01 -23.910  < 2e-16 ***
## poly(Overlap, 7)4          -9.766e+01  1.232e+01  -7.927 2.24e-15 ***
## poly(Overlap, 7)5           9.105e+01  1.136e+01   8.015 1.10e-15 ***
## poly(Overlap, 7)6           7.085e+01  8.450e+00   8.384  < 2e-16 ***
## poly(Overlap, 7)7          -3.724e+01  8.586e+00  -4.337 1.44e-05 ***
## poly(Even, 2)1                     NA         NA      NA       NA
## poly(Even, 2)2              1.926e+02  6.813e+00  28.266  < 2e-16 ***
## Overlap:Even               -4.919e+00  1.846e+00  -2.665 0.007702 **
## Overlap:N                  -2.255e-01  1.576e-02 -14.310  < 2e-16 ***
## Overlap:ModelLasso          3.360e+00  9.983e-01   3.366 0.000764 ***
## Overlap:ModelLogit          3.687e+00  1.017e+00   3.627 0.000287 ***
## Overlap:ModelRSS           -2.258e+01  1.901e+00 -11.877  < 2e-16 ***
## Even:N                     -6.782e-04  8.666e-03  -0.078 0.937618
## Even:ModelLasso            -7.685e-01  7.866e-01  -0.977 0.328535
## Even:ModelLogit            -1.171e+00  7.898e-01  -1.482 0.138262
## Even:ModelRSS               1.276e+00  8.236e-01   1.549 0.121455
## N:ModelLasso                2.923e-02  4.096e-03   7.136 9.64e-13 ***
## N:ModelLogit                2.941e-02  4.091e-03   7.190 6.46e-13 ***
## N:ModelRSS                 -1.759e-02  4.430e-03  -3.971 7.16e-05 ***
## Overlap:Even:N              2.331e-01  3.903e-02   5.973 2.34e-09 ***
## Overlap:Even:ModelLasso     5.382e+00  2.634e+00   2.043 0.041008 *
## Overlap:Even:ModelLogit     5.016e+00  2.664e+00   1.883 0.059717 .
## Overlap:Even:ModelRSS       7.889e+01  9.614e+00   8.206 2.29e-16 ***
## Overlap:N:ModelLasso       -1.863e-02  2.373e-02  -0.785 0.432344
## Overlap:N:ModelLogit       -3.402e-02  2.456e-02  -1.385 0.165950
## Overlap:N:ModelRSS          6.569e-01  5.544e-02  11.849  < 2e-16 ***
## Even:N:ModelLasso           3.412e-03  1.227e-02   0.278 0.780987
## Even:N:ModelLogit           6.165e-03  1.221e-02   0.505 0.613647
## Even:N:ModelRSS             5.394e-02  1.336e-02   4.036 5.43e-05 ***
## Overlap:Even:N:ModelLasso -3.850e-02  5.784e-02  -0.666 0.505627
```

```
## Overlap:Even:N:ModelLogit -8.350e-03  5.920e-02  -0.141 0.887828
## Overlap:Even:N:ModelRSS   -2.947e+00  3.052e-01  -9.656  < 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: 85683  on 190838  degrees of freedom
## Residual deviance: 32102  on 190800  degrees of freedom
## AIC: 32180
##
## Number of Fisher Scoring iterations: 13
```

```
## ciTools version 0.6.1 (C) Institute for Defense Analyses
```

```
##    Distribution Overlap    Even Model  N linear_predict pred_probability
## 1       Log_Log 0.36667 0.16667 Logit 60   3.254491e-04        -8.029979
## 2       Log_Log 0.36667 0.50000 Logit 60   2.378203e-03        -6.039029
## 3       Log_Log 0.36667 0.16667 Firth 60   1.225326e-03        -6.703322
## 4       Log_Log 0.36667 0.50000 Firth 60   2.457345e-03        -6.006213
## 5       Log_Log 0.36667 0.16667 Lasso 60   3.070617e-04        -8.088155
## 6       Log_Log 0.36667 0.50000 Lasso 60   2.393944e-03        -6.032416
## 7       Log_Log 0.36667 0.16667   RSS 60   1.474670e-03        -6.517845
## 8       Log_Log 0.36667 0.50000   RSS 60   1.001470e-04        -9.208772
## 9       Log_Log 0.36667 0.16667 Logit 60   6.844525e-04        -7.286207
## 10      Log_Log 0.36667 0.50000 Logit 60   8.758998e-04        -7.039383
## 11      Log_Log 0.36667 0.16667 Firth 60   2.929303e-03        -5.830057
## 12      Log_Log 0.36667 0.50000 Firth 60   2.820252e-03        -5.868105
## 13      Log_Log 0.36667 0.16667 Lasso 60   7.638968e-04        -7.176314
## 14      Log_Log 0.36667 0.50000 Lasso 60   8.869238e-04        -7.026864
## 15      Log_Log 0.36667 0.16667   RSS 60   1.041368e-03        -6.866178
## 16      Log_Log 0.36667 0.50000   RSS 60   2.864905e-08       -17.368145
## 17      Log_Log 0.36667 0.16667 Logit 60   8.806234e-03        -4.723450
## 18      Log_Log 0.36667 0.50000 Logit 60   9.293128e-03        -4.669144
## 19      Log_Log 0.36667 0.16667 Firth 60   3.734583e-04        -7.892331
## 20      Log_Log 0.36667 0.50000 Firth 60   6.734373e-04        -7.302442
## 21      Log_Log 0.36667 0.16667 Lasso 60   9.049401e-03        -4.695966
## 22      Log_Log 0.36667 0.50000 Lasso 60   9.608341e-03        -4.635469
## 23      Log_Log 0.36667 0.16667   RSS 60   1.793738e-03        -6.321658
## 24      Log_Log 0.36667 0.50000   RSS 60   9.180736e-04        -6.992315
## 25      Log_Log 0.36667 0.16667 Logit 60   6.303750e-03        -5.060287
## 26      Log_Log 0.36667 0.50000 Logit 60   7.443996e-03        -4.892876
## 27      Log_Log 0.36667 0.16667 Firth 60   1.057324e-03        -6.850956
## 28      Log_Log 0.36667 0.50000 Firth 60   9.843860e-04        -6.922508
## 29      Log_Log 0.36667 0.16667 Lasso 60   5.757677e-03        -5.151447
## 30      Log_Log 0.36667 0.50000 Lasso 60   8.046836e-03        -4.814397
## 31      Log_Log 0.36667 0.16667   RSS 60   1.135463e-03        -6.779579
## 32      Log_Log 0.36667 0.50000   RSS 60   1.882602e-06       -13.182854
##    Overlap_P  Even_P     Boot.fit     Boot.lwr     Boot.upr        CI
## 1    36.667% 16.667% 3.254491e-04 2.083419e-04 5.083480e-04        LR
## 2    36.667%     50% 2.378203e-03 1.615546e-03 3.499628e-03        LR
## 3    36.667% 16.667% 1.225326e-03 8.021136e-04 1.871417e-03        LR
## 4    36.667%     50% 2.457345e-03 1.662238e-03 3.631396e-03        LR
## 5    36.667% 16.667% 3.070617e-04 1.959009e-04 4.812684e-04        LR
## 6    36.667%     50% 2.393944e-03 1.627136e-03 3.520846e-03        LR
```

```
## 7    36.667% 16.667% 1.474670e-03 9.739755e-04 2.232182e-03        LR
## 8    36.667%     50% 1.001470e-04 3.489718e-05 2.873639e-04        LR
## 9    36.667% 16.667% 6.844525e-04 5.025231e-04 9.321847e-04       MLR
## 10   36.667%     50% 8.758998e-04 6.843973e-04 1.120927e-03       MLR
## 11   36.667% 16.667% 2.929303e-03 2.239714e-03 3.830396e-03       MLR
## 12   36.667%     50% 2.820252e-03 2.221413e-03 3.579944e-03       MLR
## 13   36.667% 16.667% 7.638968e-04 5.672388e-04 1.028665e-03       MLR
## 14   36.667%     50% 8.869238e-04 6.928896e-04 1.135233e-03       MLR
## 15   36.667% 16.667% 1.041368e-03 7.574944e-04 1.431472e-03       MLR
## 16   36.667%     50% 2.864905e-08 3.465853e-09 2.368156e-07       MLR
## 17   36.667% 16.667% 8.806234e-03 7.264076e-03 1.067227e-02 Std. Wald
## 18   36.667%     50% 9.293128e-03 8.024820e-03 1.075971e-02 Std. Wald
## 19   36.667% 16.667% 3.734583e-04 1.878715e-04 7.422388e-04 Std. Wald
## 20   36.667%     50% 6.734373e-04 4.703917e-04 9.640434e-04 Std. Wald
## 21   36.667% 16.667% 9.049401e-03 7.690446e-03 1.064592e-02 Std. Wald
## 22   36.667%     50% 9.608341e-03 8.381711e-03 1.101249e-02 Std. Wald
## 23   36.667% 16.667% 1.793738e-03 1.495428e-03 2.151427e-03 Std. Wald
## 24   36.667%     50% 9.180736e-04 7.387032e-04 1.140949e-03 Std. Wald
## 25   36.667% 16.667% 6.303750e-03 5.223264e-03 7.606037e-03 Mod. Wald
## 26   36.667%     50% 7.443996e-03 6.422886e-03 8.626032e-03 Mod. Wald
## 27   36.667% 16.667% 1.057324e-03 8.480261e-04 1.318210e-03 Mod. Wald
## 28   36.667%     50% 9.843860e-04 8.012375e-04 1.209348e-03 Mod. Wald
## 29   36.667% 16.667% 5.757677e-03 4.850460e-03 6.833412e-03 Mod. Wald
## 30   36.667%     50% 8.046836e-03 6.991821e-03 9.259560e-03 Mod. Wald
## 31   36.667% 16.667% 1.135463e-03 9.007830e-04 1.431197e-03 Mod. Wald
## 32   36.667%     50% 1.882602e-06 2.761518e-07 1.283409e-05 Mod. Wald
```

Predicted Percent Bias in a90 Estimation:

```
## [1] "The Model for Percent Bias in a90 for Log_Log is as follows:"
```

```
##
## Call:
## lm(formula = log(Perc_Bias_pos) ~ (Overlap + Even + Model + N)^4 +
##     poly(Overlap, 12) + poly(Even, 4) + poly(N, 3), data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -14.7300  -0.1548   0.0053   0.1544   2.8122
##
## Coefficients: (3 not defined because of singularities)
##                             Estimate Std. Error  t value Pr(>|t|)
## (Intercept)                2.058e+00  1.265e-02  162.670  < 2e-16 ***
## Overlap                   -2.805e+00  3.405e-02  -82.377  < 2e-16 ***
## Even                      -5.910e+00  3.652e-02 -161.809  < 2e-16 ***
## ModelLasso                 7.965e-02  1.768e-02    4.504 6.68e-06 ***
## ModelLogit                 1.573e-01  1.767e-02    8.903  < 2e-16 ***
## ModelRSS                  -1.968e-01  1.980e-02   -9.939  < 2e-16 ***
## N                         -4.556e-03  1.080e-04  -42.197  < 2e-16 ***
## poly(Overlap, 12)1                NA         NA       NA       NA
## poly(Overlap, 12)2        -2.116e+01  3.267e-01  -64.781  < 2e-16 ***
## poly(Overlap, 12)3         4.085e+00  3.246e-01   12.584  < 2e-16 ***
## poly(Overlap, 12)4         6.510e+01  3.132e-01  207.859  < 2e-16 ***
## poly(Overlap, 12)5        -5.331e+01  3.053e-01 -174.619  < 2e-16 ***
## poly(Overlap, 12)6         1.466e+01  3.001e-01   48.851  < 2e-16 ***
```

```
## poly(Overlap, 12)7        -3.168e+00  2.974e-01  -10.653  < 2e-16 ***
## poly(Overlap, 12)8         4.956e+00  2.967e-01   16.703  < 2e-16 ***
## poly(Overlap, 12)9        -5.746e+00  2.969e-01  -19.352  < 2e-16 ***
## poly(Overlap, 12)10        5.297e+00  2.959e-01   17.902  < 2e-16 ***
## poly(Overlap, 12)11       -1.273e+00  2.957e-01   -4.306 1.66e-05 ***
## poly(Overlap, 12)12        1.572e+00  2.950e-01    5.330 9.86e-08 ***
## poly(Even, 4)1                    NA         NA       NA       NA
## poly(Even, 4)2             7.181e+01  2.983e-01  240.714  < 2e-16 ***
## poly(Even, 4)3             1.928e+00  3.343e-01    5.768 8.05e-09 ***
## poly(Even, 4)4             3.952e+01  3.349e-01  118.021  < 2e-16 ***
## poly(N, 3)1                       NA         NA       NA       NA
## poly(N, 3)2               -2.605e+00  3.054e-01   -8.531  < 2e-16 ***
## poly(N, 3)3               -6.991e-01  2.998e-01   -2.332  0.01970 *
## Overlap:Even               5.617e+00  9.600e-02   58.511  < 2e-16 ***
## Overlap:ModelLasso        -1.443e-01  4.767e-02   -3.026  0.00248 **
## Overlap:ModelLogit        -6.227e-01  4.746e-02  -13.120  < 2e-16 ***
## Overlap:ModelRSS          -4.578e-02  5.200e-02   -0.880  0.37866
## Overlap:N                  6.320e-03  2.738e-04   23.083  < 2e-16 ***
## Even:ModelLasso           -3.668e-01  5.144e-02   -7.132 9.96e-13 ***
## Even:ModelLogit           -7.646e-01  5.135e-02  -14.892  < 2e-16 ***
## Even:ModelRSS              7.242e-01  5.746e-02   12.604  < 2e-16 ***
## Even:N                     1.492e-02  3.095e-04   48.198  < 2e-16 ***
## ModelLasso:N               7.765e-04  1.515e-04    5.126 2.96e-07 ***
## ModelLogit:N              -2.145e-04  1.514e-04   -1.417  0.15662
## ModelRSS:N                 1.507e-03  1.598e-04    9.434  < 2e-16 ***
## Overlap:Even:ModelLasso    1.131e+00  1.357e-01    8.334  < 2e-16 ***
## Overlap:Even:ModelLogit    1.776e+00  1.345e-01   13.211  < 2e-16 ***
## Overlap:Even:ModelRSS     -1.670e+00  1.473e-01  -11.342  < 2e-16 ***
## Overlap:Even:N            -2.185e-02  7.659e-04  -28.521  < 2e-16 ***
## Overlap:ModelLasso:N      -1.040e-03  3.854e-04   -2.698  0.00697 **
## Overlap:ModelLogit:N       2.311e-03  3.844e-04    6.013 1.82e-09 ***
## Overlap:ModelRSS:N        -9.470e-04  4.046e-04   -2.341  0.01924 *
## Even:ModelLasso:N         -4.062e-04  4.378e-04   -0.928  0.35348
## Even:ModelLogit:N          2.760e-03  4.373e-04    6.312 2.77e-10 ***
## Even:ModelRSS:N           -4.319e-03  4.613e-04   -9.361  < 2e-16 ***
## Overlap:Even:ModelLasso:N -2.121e-03  1.087e-03   -1.951  0.05109 .
## Overlap:Even:ModelLogit:N -7.601e-03  1.081e-03   -7.030 2.08e-12 ***
## Overlap:Even:ModelRSS:N    1.116e-02  1.139e-03    9.802  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2934 on 187640 degrees of freedom
##   (3151 observations deleted due to missingness)
## Multiple R-squared:  0.8181, Adjusted R-squared:  0.8181
## F-statistic: 1.796e+04 on 47 and 187640 DF,  p-value: < 2.2e-16
```

```
##   Distribution Overlap    Even Model  N percent.bias low.confidence
## 1      Log_Log 0.36667 0.16667 Logit 60    1.2594381      1.2445939
## 2      Log_Log 0.36667 0.50000 Logit 60   -0.1989873     -0.2030068
## 3      Log_Log 0.36667 0.16667 Firth 60    1.3663448      1.3506957
## 4      Log_Log 0.36667 0.50000 Firth 60   -0.1481165     -0.1525249
## 5      Log_Log 0.36667 0.16667 Lasso 60    1.4665797      1.4501611
## 6      Log_Log 0.36667 0.50000 Lasso 60   -0.1248561     -0.1294773
## 7      Log_Log 0.36667 0.16667   RSS 60    1.1144847      1.1005791
```

```
## 8      Log_Log 0.36667 0.50000   RSS 60   -0.2013129     -0.2056854
##   up.confidence low.pred.interval up.pred.interval Overlap_P  Even_P
## 1     1.2743935         0.3867500        2.8104414   36.667% 16.667%
## 2    -0.1949375        -0.4338483        0.2184246   36.667%     50%
## 3     1.3821113         0.4469021        3.0004438   36.667% 16.667%
## 4    -0.1436748        -0.4052254        0.3088361   36.667%     50%
## 5     1.4831217         0.5033002        3.1785891   36.667% 16.667%
## 6    -0.1201997        -0.3921380        0.3501770   36.667%     50%
## 7     1.1284956         0.3051895        2.5528232   36.667% 16.667%
## 8    -0.1969044        -0.4351597        0.2143005   36.667%     50%
```