

Q.N. 1) *mtcars* data in R describes different models of a car with their various engine specifications. In "mtcars" data set, the transmission mode (automatic or manual) is described by the column *am* which is a binary value (0 or 1).

a) Create a simple logistic regression model using weight as a predictor variable.

```
> model=glm(am~wt,family=binomial)
> model

Call:  glm(formula = am ~ wt, family = binomial)

Coefficients:
(Intercept)          wt
    12.040         -4.024

Degrees of Freedom: 31 Total (i.e. Null);  30 Residual
Null Deviance:      43.23
Residual Deviance: 19.18      AIC: 23.18
> |
```

$$\Pi = [1 + \exp(-12.040 + 4.024wt)]$$

b) Perform the test of significance of the weight of the car.

```
> summary(model)

Call:
glm(formula = am ~ wt, family = binomial)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.11400  -0.53738  -0.08811   0.26055   2.19931

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  12.040      4.510   2.670  0.00759 **
wt           -4.024      1.436  -2.801  0.00509 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 43.230  on 31  degrees of freedom
Residual deviance: 19.176  on 30  degrees of freedom
AIC: 23.176

Number of Fisher Scoring iterations: 6
```

$\Pr(>|z|)$ value 0.00759 is too small. We reject $H_0(b_1 \text{ is not important})$ and accept $H_1(b_1 \text{ exists})$

c) What is the probability that a 2000 lbs car is manual?

```

> predict(model,data.frame(wt=2),type="resp")
Error: unexpected input in "predict(model,data.frame(wt=2),type="
> predict(model,data.frame(wt=2),type="response")
Error: unexpected input in "predict(model,data.frame(wt=2),type="
> predict(model,data.frame(wt=2),type="resp")
1
0.9818796
> predict(model,data.frame(wt=2),type="response")
1
0.9818796
> |

```

Q.N. 2) Breast Cancer Wisconsin (Diagnostic) Data Set contains 569 observations with 32 variables including 1) ID number 2) Diagnosis (M = malignant, B = benign) 3) Radius,

a) Import the data in R.

```

R Console
> Q2=read.table("C:\\Users\\Zhang\\Downloads\\wdbc.data",sep=",")
> head(Q2)
  V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11
1  842302 M 17.99 10.38 122.80 1001.0 0.11840 0.27760 0.3001 0.14710 0.2419
2  842517 M 20.57 17.77 132.90 1326.0 0.08474 0.07864 0.0869 0.07017 0.1812
3  84300903 M 19.69 21.25 130.00 1203.0 0.10960 0.15990 0.1974 0.12790 0.2069
4  84348301 M 11.42 20.38 77.58 386.1 0.14250 0.28390 0.2414 0.10520 0.2597
5  84358402 M 20.29 14.34 135.10 1297.0 0.10030 0.13280 0.1980 0.10430 0.1809
6  843786 M 12.45 15.70 82.57 477.1 0.12780 0.17000 0.1578 0.08089 0.2087
  V12 V13 V14 V15 V16 V17 V18 V19 V20 V21
1 0.07871 1.0950 0.9053 8.589 153.40 0.006399 0.04904 0.05373 0.01587 0.03003
2 0.05667 0.5435 0.7339 3.398 74.08 0.005225 0.01308 0.01860 0.01340 0.01389
3 0.05999 0.7456 0.7869 4.585 94.03 0.006150 0.04006 0.03832 0.02058 0.02250
4 0.09744 0.4956 1.1560 3.445 27.23 0.009110 0.07458 0.05661 0.01867 0.05963
5 0.05883 0.7572 0.7813 5.438 94.44 0.011490 0.02461 0.05688 0.01885 0.01756
6 0.07613 0.3345 0.8902 2.217 27.19 0.007510 0.03345 0.03672 0.01137 0.02165
  V22 V23 V24 V25 V26 V27 V28 V29 V30 V31 V32
1 0.006193 25.38 17.33 184.60 2019.0 0.1622 0.6656 0.7119 0.2654 0.4601 0.11890
2 0.003532 24.99 23.41 158.80 1956.0 0.1238 0.1866 0.2416 0.1860 0.2750 0.08902
3 0.004571 23.57 25.53 152.50 1709.0 0.1444 0.4245 0.4504 0.2430 0.3613 0.08758
4 0.009208 14.91 26.50 98.87 567.7 0.2098 0.8663 0.6869 0.2575 0.6638 0.17300
5 0.005115 22.54 16.67 152.20 1575.0 0.1374 0.2050 0.4000 0.1625 0.2364 0.07678
6 0.005082 15.47 23.75 103.40 741.6 0.1791 0.5249 0.5355 0.1741 0.3985 0.12440
> attach(Q2)
> |

```

b) Fit a simple logistic regression model using Radius as a predictor variable.

```

> m2=glm(V2~V3,family="binomial")
> m2

Call: glm(formula = V2 ~ V3, family = "binomial")

Coefficients:
(Intercept)          V3
    -15.246         1.034

Degrees of Freedom: 568 Total (i.e. Null); 567 Residual
Null Deviance: 751.4
Residual Deviance: 330 AIC: 334
> |

```

$$P = \frac{1}{1 + \exp(-15.246 + 1.034V3)}$$

