

## Practice questions

1. For the 23 space shuttle flights that occurred before the Challenger mission disaster in 1986, the data below shows the temperature in fahrenheit at the time of the flight and whether at least one primary O-ring suffered thermal distress (Yes=1 and 0=No)

Flight	Temperature (x)	ThermalDistress (y)
1	66	0
2	70	1
3	69	0
4	68	0
5	67	0
6	72	0
7	73	0
8	70	0
9	57	1
10	63	1
11	70	1
12	78	0
13	67	0
14	53	1
15	67	0
16	75	0
17	70	0
18	81	0
19	76	0
20	79	0
21	75	1
22	76	0
23	58	1

A logistic regression model

$$\text{logit}(\pi(x)) = \beta_0 + \beta_1 x$$

where  $\pi(x) = P(y = 1|x)$  was used to analyze these data and the the result is

```
> fit<-glm(y~x, family=binomial)
> fit
```

```
Call: glm(formula = y ~ x, family = binomial)
```

Coefficients:

```
(Intercept)          x
  15.0429      -0.2322
```

```
Degrees of Freedom: 22 Total (i.e. Null);  21 Residual
```

Null Deviance: 28.27  
 Residual Deviance: 20.32 AIC: 24.32

- (a) Give the estimated logistic regression equation and interpret  $b_1$  the estimate of the slope  $\beta_1$
- (b) Estimate the  $\pi(65)$  using a 95% confidence interval if the estimated covariance of  $b_0$  and  $b_1$  is given by

```
> vcov(fit)
              (Intercept)              x
(Intercept)  54.4441826 -0.79638547
x            -0.7963855  0.01171512
```

2. In a logistic regression with five predictors it is found that the residual deviances of the following models

$$\begin{aligned}\text{logit}(\pi(x_1, x_2, x_3, x_4, x_5)) &= \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 \\ \text{logit}(\pi(x_1, x_2, x_3)) &= \beta_0 + \beta_1 x_1 + \beta_2 x_2\end{aligned}$$

are 14.60 and 21.70, respectively. Test

$$\begin{aligned}H_0 &: \text{logit}(\pi(x)) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 \quad \text{against} \\ H_a &: \text{logit}(\pi(x)) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5\end{aligned}$$

using  $\alpha = 0.05$ .