Part1 - a)

Let $\mathbf{A_1}$ be the event that the person selected has lung disease and $\mathbf{A_2}$ be the event that the person selected has no lung disease.

$\mathbf{P(A_1)}$ = 0.07 and $\mathbf{P(A_2)}$ = 1 - $P(A_1)$ = 0.93

Let **C** be the event that the person selected is a nonsmoker. From the given data, the likelihood probabilities are

$\mathbf{P(C|A_1)}$ = 0.1 and $\mathbf{P(C|A_2)}$ = 0.75.

The probability that a randomly selected nonsmoker has lung disease is

$$\boldsymbol{P(A_1|C) = \frac{P(A_1) * P(C|A_1)}{P(A_1) * P(C|A_1) + P(A_2) * P(C|A_2)}}$$

$$\boldsymbol{\frac{0.07 * 0.1}{0.07 * 0.1 + 0.93 * 0.75} = 0.0099}$$

The probability that a randomly selected nonsmoker does not have lung disease is

$$\boldsymbol{P(A_2|C) = \frac{P(A_2) * P(C|A_2)}{P(A_1) * P(C|A_1) + P(A_2) * P(C|A_2)}}$$

$$\boldsymbol{\frac{0.93 * 0.75}{0.07 * 0.1 + 0.93 * 0.75} = 0.9901}$$

Part1 – b)

P(D) = 0.4, P(R) = 0.5, P(I) = 0.1
B = favors sales tax
P(B|D) = 0.7, P(B|R) = 0.4, P(B|I) = 0.2

Denominator = P(D) * P(B|D) + P(R) * P(B|R) + P(I) * P(B|I) = 0.5

P(D|B) = P(D)*P(B|D) / Denominator = 0.28/0.5 = 0.56
P(R|B) = P(R)*P(B|R) / Denominator = 0.2/0.5 = 0.4
P(I|B) = P(I)*P(B|I) / Denominator = 0.02/0.5 = 0.04

Part2

a)

S = {(1,1), (2,1) …, (5,6), (6,6)}

$X : S \rightarrow R$

For every (x1, x2) ∈ S, X(x1,x2) = |x1 – x2|

Support of X = {0, 1, 2, 3, 4, 5}

b)

```
library(prob)
S <- rolldie(2, makespace = TRUE)
S <- addrv(S, U = abs(X1 - X2))

Prob(S, U == 3)
Prob(S, U <= 3)
Prob(S, U > 3)
```

c)

```
marginal(S, vars = "U")
```

d)

```
is.double <- function (x) {
  if ((x[1] == 2 * x[2]) | (x[2] == 2 * x[1])) {
    return (TRUE)
  } else
  {
    return (FALSE)
  }
}

S <- addrv(S, FUN = is.double, invars = c("X1", "X2"), name = "V")

Prob(S, V == TRUE)

marginal(S, vars = "V")
```