Exercise: Bayes net for a rainy day

(Source: Nando de Freitas.). In this question you must model a problem with 4 binary variables: G ="gray", V ="Vancouver", R ="rain" and S ="sad". Consider the directed graphical model describing the relationship between these variables shown in Figure 1.

1. Write down an expression for $P(S = 1|V = 1)$ in terms of $\alpha, \beta, \gamma, \delta$.
2. Write down an expression for $P(S = 1|V = 0)$. Is this the same or different to $P(S = 1|V = 1)$? Explain why.
3. Find maximum likelihood estimates of α, β, γ using the following data set, where each row is a training case. (You may state your answers without proof.)

V	G	R	S
1	1	1	1
1	1	0	1
1	0	0	0

(1)

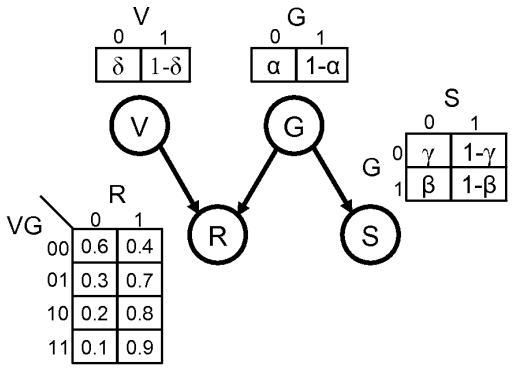

Figure 1: Bayes net for a rainy day.