Homework 6

Due 3/5

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1. (a) The joint entropy is (where $\log = \log_2$)

$$\begin{aligned} H(V,T) &= \sum_{V,T} p(V,T) \log\left(\frac{1}{p(V,T)}\right) \\ &= \left[\frac{6}{16}\log(16) + \frac{4}{32}\log(32) + \frac{2}{8}\log(8) + \frac{1}{4}\log(4)\right] \\ &= 3.38 \text{ bits} \end{aligned}$$

(b) Given the marginal probability

$$\begin{aligned} p(V = \text{Sunny}) &= \frac{1}{16} + \frac{1}{16} + \frac{1}{16} + \frac{1}{16} = \frac{4}{16} = \frac{1}{4} \\ p(V = \text{Cloudy \& dry}) &= \frac{1}{16} + \frac{1}{8} + \frac{1}{32} + \frac{1}{32} = \frac{8}{32} = \frac{1}{4} \\ p(V = \text{Cloudy \& rain}) &= \frac{1}{4} \\ p(V = \text{Cloudy \& snow}) &= \frac{1}{4} \end{aligned}$$

marginal entropy of V is

$$\begin{aligned} H(V) &= \sum_{V} p(V) \log\left(\frac{1}{p(V)}\right) \\ &= \frac{1}{4}\log(4) + \frac{1}{4}\log(4) + \frac{1}{4}\log(4) + \frac{1}{4}\log(4) \\ &= 2\text{bits} \end{aligned}$$