UNIVERSITY COMPUTER SCIENCE • EXERCISE SHEET

13.3 Probability models

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS Bayesian network • inference

Objective

Compute posteriors by enumeration and respect base rates.

1 Key knowledge and worked examples

■ **The net**

Storm → Delay → {Late, Complaint}, with P(S) = 0.3, P(D given S) = 0.8, P(D given not S) = 0.1, P(C given D) = 0.6, P(C given not D) = 0.05 ✓.

■ **Worked example: the posterior**

$P(C) = 0.2205$; $P(S \mid C) = 0.667$; with $P(S) = 0.03$ the posterior falls to 0.126 ✓.

2 Practice

2.1 What does the network factorise? [3]

2.2 Compute $P(D)$. [3]

2.3 Name the two fallacies this unit warns about. [3]

3 Exam-style questions

3.1 Using the course net, compute $P(D \mid C)$.

Enumerate: $P(C \mid D)P(D)$ and $P(C \mid \neg D)P(\neg D)$; give $P(C)$ and then $P(D \mid C)$. Give $P(S \mid C)$ from the same normaliser and state which cause the complaint implicates more. Explain in one line why the two posteriors sum to more than 1. [8]

3.2 The storm prior drops to 0.03 (rare storms).

Recompute $P(C)$ and $P(S \mid C)$. State which changed most and why. Give the screening-test reading of the same arithmetic (a rare disease, a positive test) and the design lesson for tests used at scale. [7]