# CSE 312: Foundations of Computing II

## QuickCheck: Conditional Probability Solutions

### 0. Everyday is Championship Day

The Seahawks are considering you for the 3rd-string quarterback (QB) position (behind the 1st- and 2nd-string QBs). The probability the Seahawks win the Super Bowl next season is 0.4. The probability that the 1st-string QB is starting the playoffs is 0.91. The probability that the 2nd-string QB is starting the playoffs is 0.08.

(a) What is the probability that you will be starting the playoffs? The Seahawks only use 1st-, 2nd-, and 3rd-string QBs.

**Solution:**

Let R = event that the starter is starting, B = backup is starting, Y = you are starting.
$\Pr(R) + \Pr(B) + \Pr(Y) = 1$, so $\Pr(Y) = 1 - 0.91 - 0.08 = 0.01$
Because R, B, Y exhaustively partition the sample space.

(b) The probability the Seahawks win the Super Bowl AND the 1st-string QB starts the playoffs is 0.39. The chances of them winning the Super Bowl given the 2nd-string QB starts is 0.11. What is the chance they win the Super Bowl given that you (3rd-string) are the starting quarterback?

**Solution:**

Let S = Seahawks win the Super Bowl, by the law of total probability:
$\Pr(S) = \Pr(S \mid R)\Pr(R) + \Pr(S \mid B)\Pr(B) + \Pr(S \mid Y)\Pr(Y)$
$0.4 = 0.39 + 0.11 * 0.08 + \Pr(S \mid Y) * 0.01$
$\Pr(S \mid Y) = 0.12$

(c) Suppose you are starting during the playoffs, what is probability the Seahawks will not win the Super Bowl?

**Solution:**

$\Pr(\bar{S} \mid Y) = 1 - \Pr(S \mid Y) = 0.88$