On The Complexity of Simplification

(A True Story by Michael Corum)

18th April 2003

Graduate Student: knock-knock.
Thesis Committee: Who’s there?
Graduate Student: \( \tilde{Q}(t) \).
Thesis Committee: \( \tilde{Q}(t) \) who?
Graduate Student: \( \tilde{Q}(t) = \sum_{d_1, \ldots, d_s} p(d_1, \ldots, d_s, t) \prod_{j=1}^{s} \tilde{Q}_{d_j} \) where

\[
p(d_1, \ldots, d_s, t) = p(d_1, \ldots, d_s, t) \prod_{j=1}^{s} \tilde{q}_j(d_j) + \sum_{i=1}^{s} p(d_1, \ldots, d_i+1, \ldots, d_s, t) \prod_{j=1}^{i-1} \tilde{q}_j(d_j) \tilde{p}_i(d_i+1).
\]


Graduate Student: knock-knock.
Thesis Committee: Who’s there?
Graduate Student: \( \tilde{Q}(t) \).
Thesis Committee: \( \tilde{Q}(t) \) who?
Graduate Student: \( \tilde{Q}(t) = \pi_{0} p^{0} \beta \), with \( P \) \( n \times n \) and very sparse.
Graduate Student: knock-knock.
Thesis Committee: Who’s there?
Graduate Student: $Q(t)$.
Thesis Committee: $Q(t)$ who?
Graduate Student: $Q(t) = \pi_0 \hat{P} t \hat{P}$, with $\hat{P}$ sXn and compact
Thesis Committee: Make it so.

Graduate Student: knock-knock.
Thesis Committee: Who’s there?
Graduate Student: Code review!
Thesis Committee: Code review, who?
Graduate Student:

```java
/**
 * Compute the probability of system survival after t tests.
 * @param tests The number of tests that have been run.
 * <p>The first row of vPi holds $\pi_t$ and the second holds $\pi_{t-1}$.
 */
private static void computeQ(int tests) {
    vPi[1][0] = 1.0;
    Q[0]=P[s][0];
    for (int t = 1; t <= tests; t++) {
        for(int i = 0; i < states; i++) {
            // Success.
            vPi[0][i] += vPi[1][i] * P[s][i];
            // Failure in stage j.
            for (int j = 0; j < stages; j++) {
                if (i >= offset[j]) {
                    vPi[0][i] += vPi[1][i-offset[j]] * P[j][i-offset[j]];
                }
            }
            double rel = 0.0;
            // Store new vPi in second row, and compute reliability.
            for (int i = 0; i < states; i++) {
                vPi[1][i] = vPi[0][i];
                rel += vPi[0][i] * P[s][i];
                vPi[0][i] = 0.0;
            }
            Q[t]= rel;
        }
    }
    Thesis Committee: What the hell is that?
    Graduate Student: Simpler. Shorter. Faster.
```