**Constraint Propagation**


• **Three sample problems**

• **An educational application making use of constraints**

• **Constraints in Ising systems and Cellular Automata**

## An Example of an Event Constraint System (from Cormen, Leiserson, and Rivest)

Event **1** must occur at least **0** before event **2**.
Event **1** must occur at least **1** before event **5**.
Event **2** must occur before or at most **1** after event **5**.
Event **3** must occur before or at most **5** after event **1**.
Event **4** must occur before or at most **4** after event **1**.
Event **4** must occur at least **1** before event **3**.
Event **5** must occur at least **3** before event **3**.
Event **5** must occur at least **3** before event **4**.

```
X1 — X2 <=  0
X1 — X5 <= -1
X2 — X5 <=  1
X3 — X1 <=  5
X4 — X1 <=  4
X4 — X3 <= -1
X5 — X3 <= -3
X5 — X4 <= -3
```

| Event | Time |
|-------|------|
| X1 | -5 |
| X2 | -3 |
| X3 | 0 |
| X4 | -1 |
| X5 | -4 |

**Constraint Propagation: Recurring Issues**

- **Do we want a "solution"?**

- **Existence (of a solution)**

- **Uniqueness**

- **"Hard" vs. "Soft" constraints**

- **Evolution of networks**

- **Relaxation as a general strategy**