

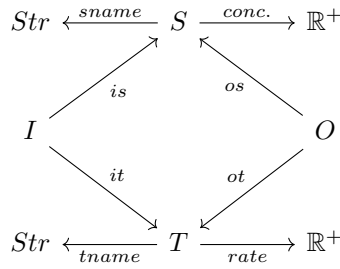
# Petri Net JSON Schema

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## Formulation

We can define a Petri net to be the following diagram of finite sets



Here,  $T$  is the set of transitions,  $S$  is the set of states,  $I$  is the set of input edges from some state  $s$  to some transition  $t$ , and  $O$  is the set of output edges from some transition  $t$  to some state  $s$  where  $s \in S$  and  $t \in T$ . Along with these definitions for transitions, we also have maps from  $S \rightarrow \mathbb{R}^+$  that map states to their initial concentrations and  $S \rightarrow Str$  that map states to labels. Similarly, we have maps from  $T \rightarrow \mathbb{R}^+$  that map transitions to their transition rates and  $T \rightarrow Str$  that map transitions to labels.

With this formulation, we can naturally convert the resulting structure into JSON schema:

```
{
  "T": [
    { "rate": 0.0003, "tname": "inf" },
    { "rate": 0.2, "tname": "rec" }
  ],
  "S": [
    { "concentration": 990, "sname": "S" },
    { "concentration": 10, "sname": "I" },
    { "concentration": 0, "sname": "R" }
  ],
  "I": [
    { "it": 1, "is": 1 },
    { "it": 1, "is": 2 },
    { "it": 2, "is": 2 }
  ],
  "O": [
    { "ot": 1, "os": 2 },
    { "ot": 1, "os": 2 },
    { "ot": 2, "os": 3 }
  ]
}
```

### Fields:

- T: an array of transitions each with both a **rate** and **tname** specified to represent the transition rate and the label of the transition respectively
- S: an array of states each with both a **concentration** and **sname** specified to represent the initial concentration and the label of the state respectively
- I: an array of input edges each with an input transition (**it**) and input state (**is**) whose values are indexes into the T and S arrays respectively. These represent an edge from state **is** to transition **it**.
- O: an array of output edges each with an output transition (**it**) and output state (**is**) whose values are indexes into the T and S arrays respectively. These represent an edge from transition **it** to state **is**.

### SIR Example

```
{
  "T": [
    { "rate": 0.0003, "tname": "inf" },
    { "rate": 0.2, "tname": "rec" }
  ],
  "S": [
    { "concentration": 990, "sname": "S" },
    { "concentration": 10, "sname": "I" },
    { "concentration": 0, "sname": "R" }
  ],
  "I": [
    { "it": 1, "is": 1 },
    { "it": 1, "is": 2 },
    { "it": 2, "is": 2 }
  ],
  "O": [
    { "ot": 1, "os": 2 },
    { "ot": 1, "os": 2 },
    { "ot": 2, "os": 3 }
  ]
}
```

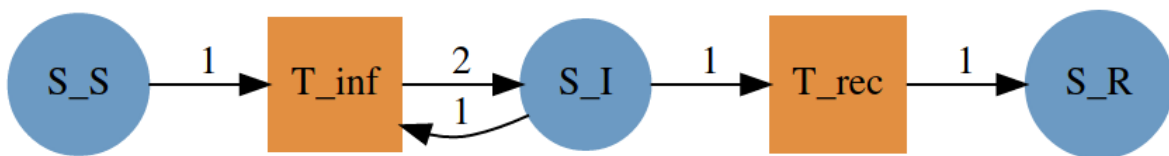


Figure 1: Resulting SIR Petri Net