SCHOOL OF RANDOM DEPARTMENT NAMES

This is the title of the template report

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The subject of this internship is first modeling some system in the PrismGSMP. That is a continuous system with rates instead of probabilistic transition. Transitiom are syncronized with event which follows some probabilistic laws like exponential law or dirac. One good property about the exponenial law is the events are markovian. That is the probability of the event of happening doenst depends on the time already spend.

1 QUEUE : A TOY EXAMPLE

We considere a M/M/1/n queue (see Kendall notation).

1.1 FIRST MODEL

1.2 SECOND MODEL(USING PHASE TYPE FITTING)

The timeout part is replaced by k μ transition following the exponential law of parameter μ. Here on the figure, k=5, which mean that you need 5 consecutive μ transition to $produce$.

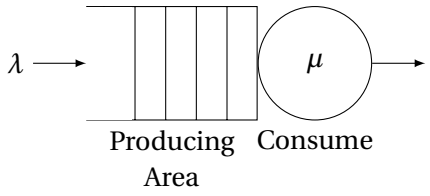

Figure 1.1: a queue

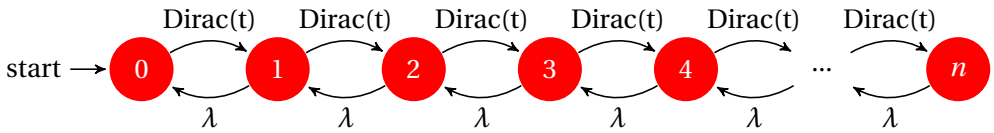

Figure 1.2: Queue with n capacity, the current size is written on the states

```
gsmp

const int qCapacity = 10;

const double timeout = 10;
const double lambda = 0.2;

module main
event prod = dirac(timeout);

qSize : [0..qCapacity] init 0;

[produce] (qSize < qCapacity)--prod -> (qSize' = qSize+1);
[consume] (qSize > 0) -> lambda: (qSize' = qSize - 1);

endmodule
```

Figure 1.3: Prism code for figure 1.2

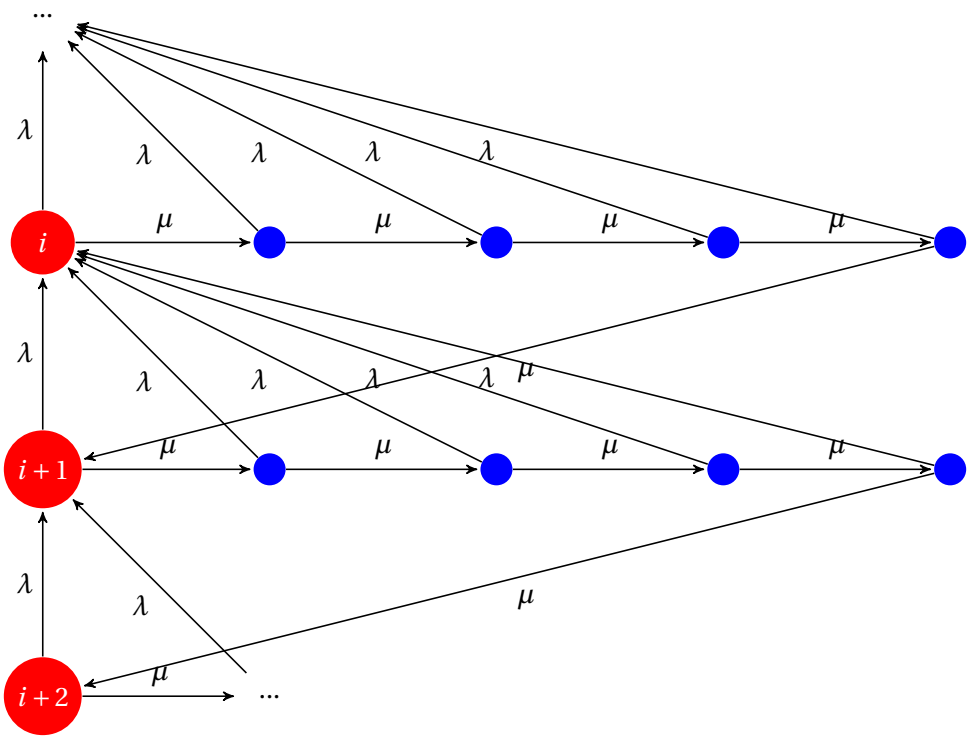

Figure 1.4: Queue with phase type fitting of parameter k

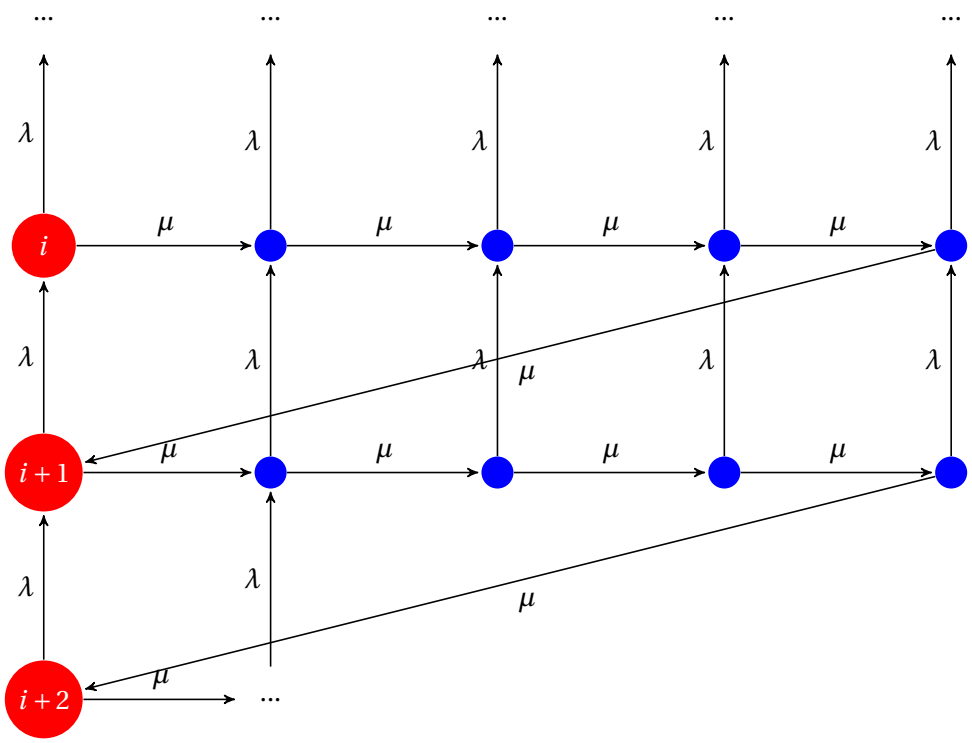

Figure 1.5: Queue with phase type fitting of parameter k

```
gsmp

const int k = 10;
const int qCapacity = 10;

const double timeout = 10;
const double lambda = 0.2;



module main

qSize : [0..qCapacity] init 0;

[produce] (qSize < qCapacity) -> (qSize' = qSize+1);
[consume] (qSize > 0) -> lambda: (qSize' = qSize - 1);

endmodule

module trigger

i : [1..k+1];

[] i < k -> k/timeout : (i'=i+1);
[produce] i = k -> k/timeout : (i'=1);
//[consume] true -> (i'=1);

endmodule
```

Figure 1.6: Caption

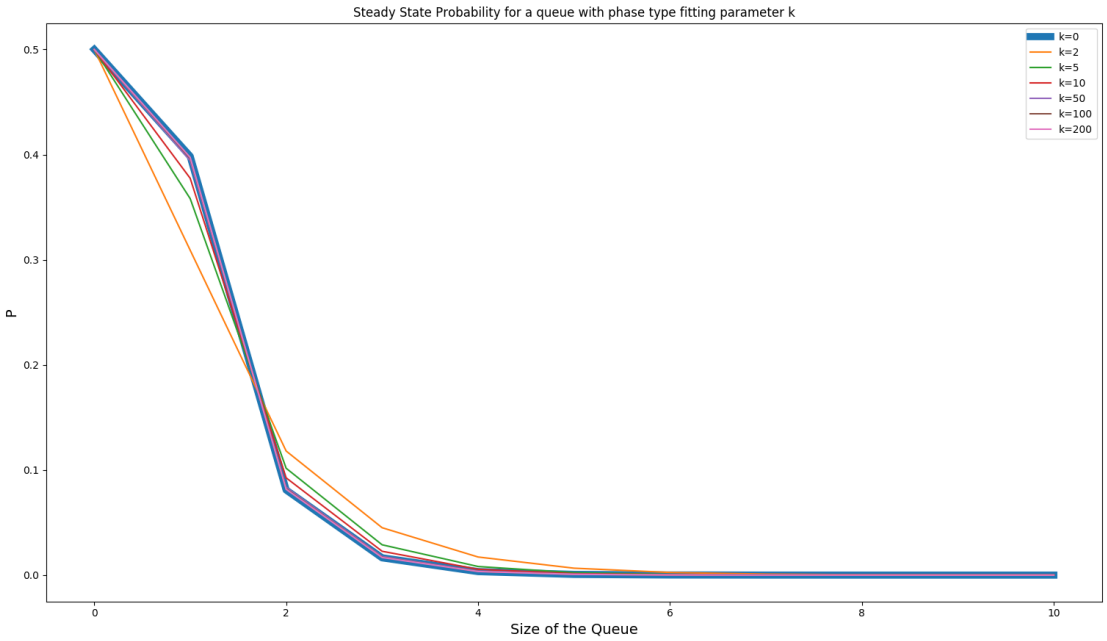

Figure 1.7: The blue line is the result without phase type fitting

1.3 FINDING μ

According to Prism documentation on phase type fittimg, we should take $\mu = t/k$. The mean of diract(t) is t, and the mean of exponential(μ) is $1/\mu$. Hence $\mu = t/k$.

1.4 RESULTS

For a queue capacity of 10, we compare the steady state probabilities according to k the parameter of phase type fitting.

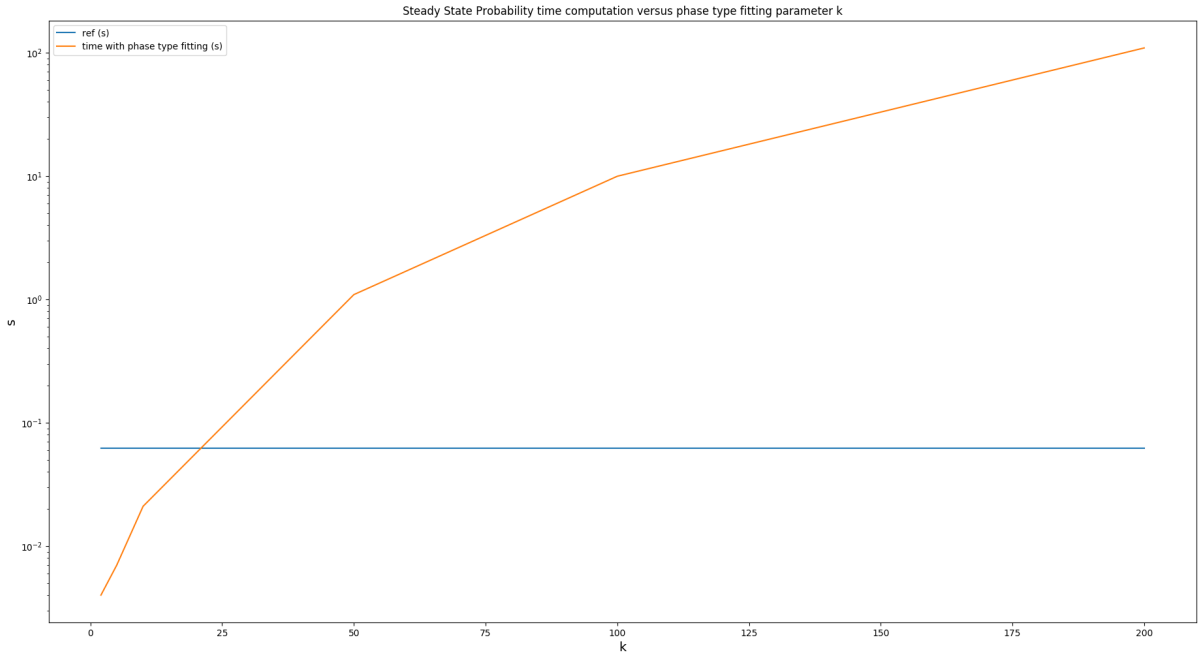

Figure 1.8: time of computation versus k

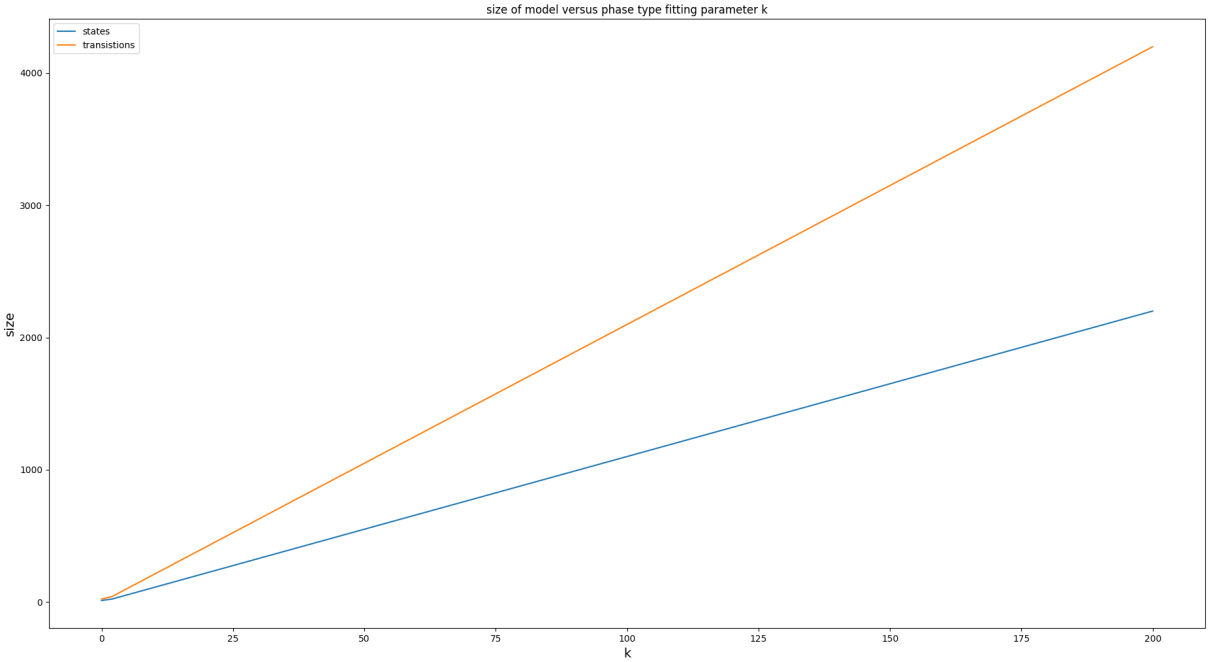

Figure 1.9: size of model versus k