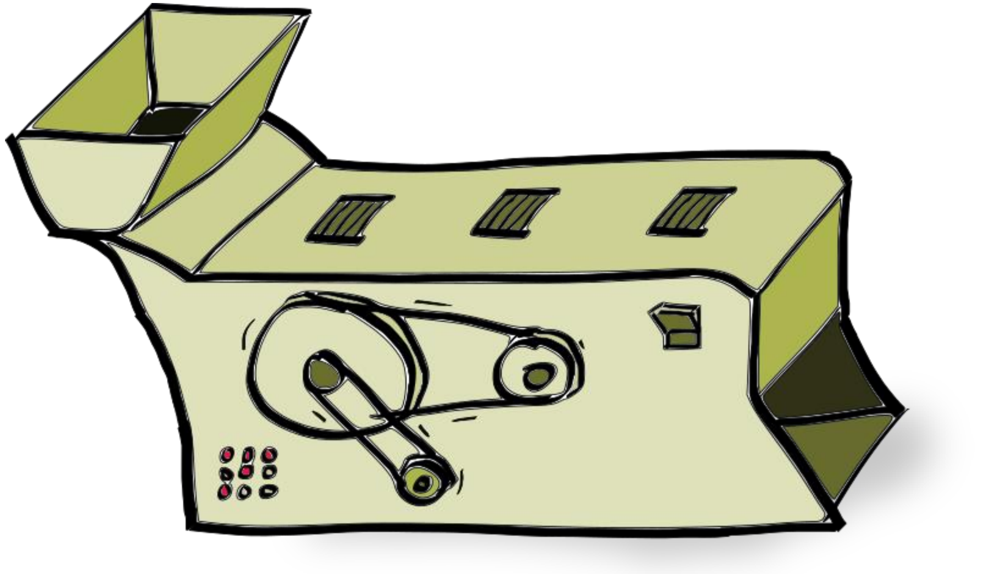
At any given time, a machine is “working” or “broken”.

It works for an exponentially distributed number of days, with rate 0.1 days.

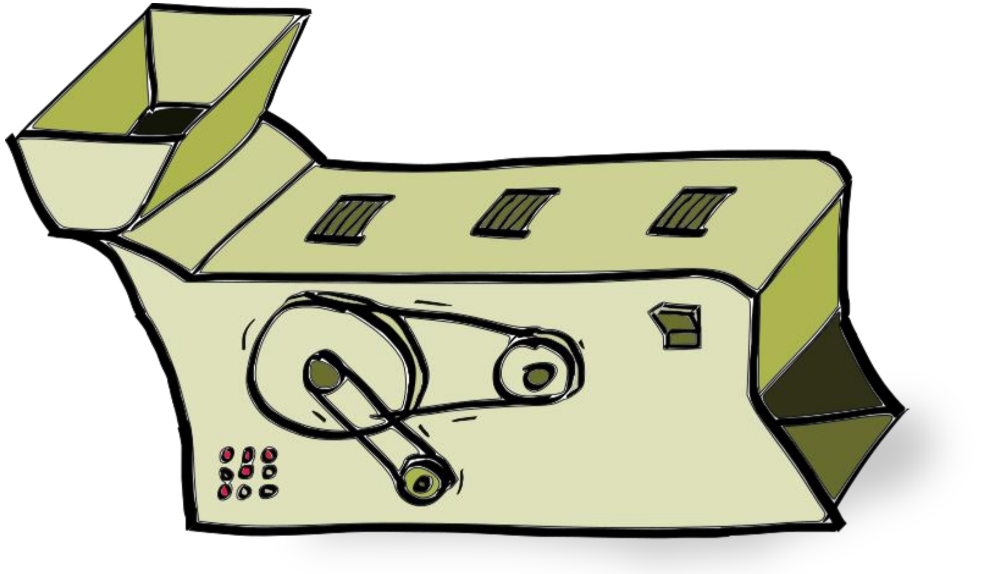
Once broken, it takes an exponentially distributed number of days to fix, with mean 1 day.



1. What is the state space of this continuous time Markov process? {Working, Broken}
2. State the rate at which the process:
   i. Goes from “Working” to “Broken”; 0.1
   ii. Goes from “Broken” to “Working”. 1
3. How long, on average, will the machine be working for before it breaks? 10 days
4. The machine has been working for 5 days. State the distribution of the further amount of time until it breaks. Exponential(0.1) (memoryless property!)
5. Find the transition matrix for the implied jump chain.

$$P = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$

Let X_t denote the status of a machine at time t and suppose that $\{X_t; t \geq 0\}$ is a continuous time Markov process.



At any given time, a machine is “working”, “broken (easy repair)” or “broken (difficult repair)”.

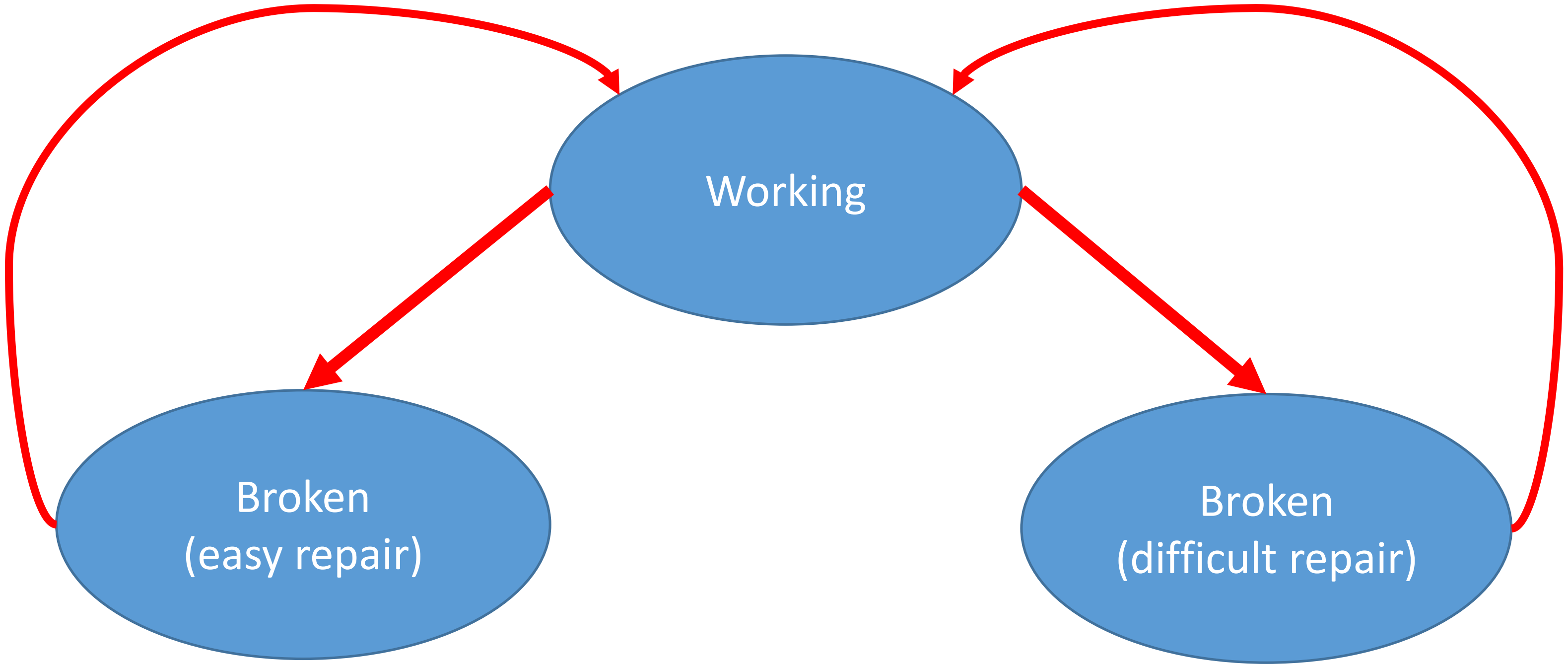
When it breaks, the process moves to “broken (easy repair)” with rate 0.08.

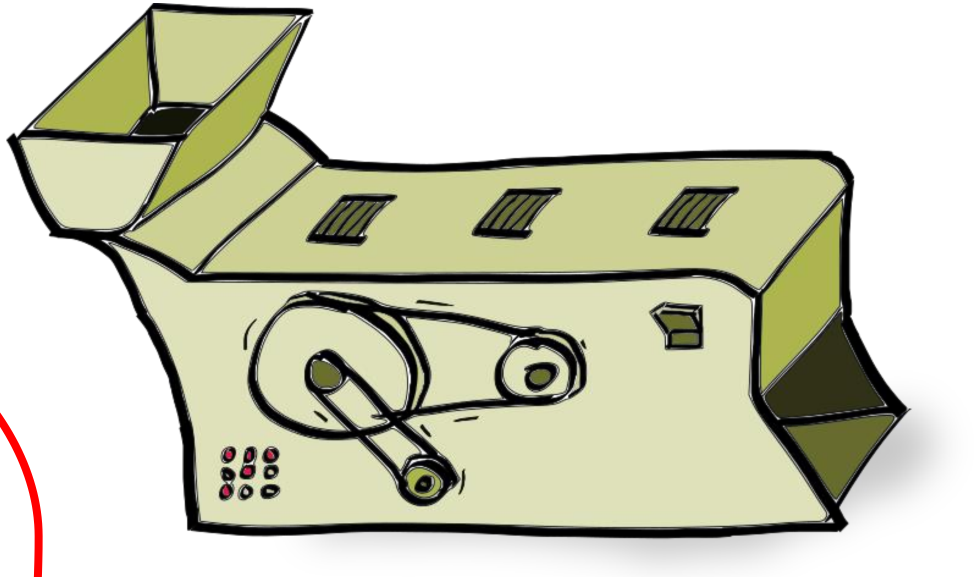
When it breaks, the process moves to “broken (difficult repair)” with rate 0.02.

If broken (difficult repair), it takes an exponentially distributed number of days to fix, with mean 2 days.
If broken (easy repair), it takes an exponentially distributed number of days to fix, with mean 1 days.

1. Draw a state space diagram for this process.
2. What is the distribution of time for which the process remains working?
3. Compute the transition matrix of the jump chain.

Let X_t denote the status of a machine at time t and suppose that $\{X_t;\ t \geq 0\}$ is a continuous time Markov process.





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2. What is the distribution of time for which the process remains working?
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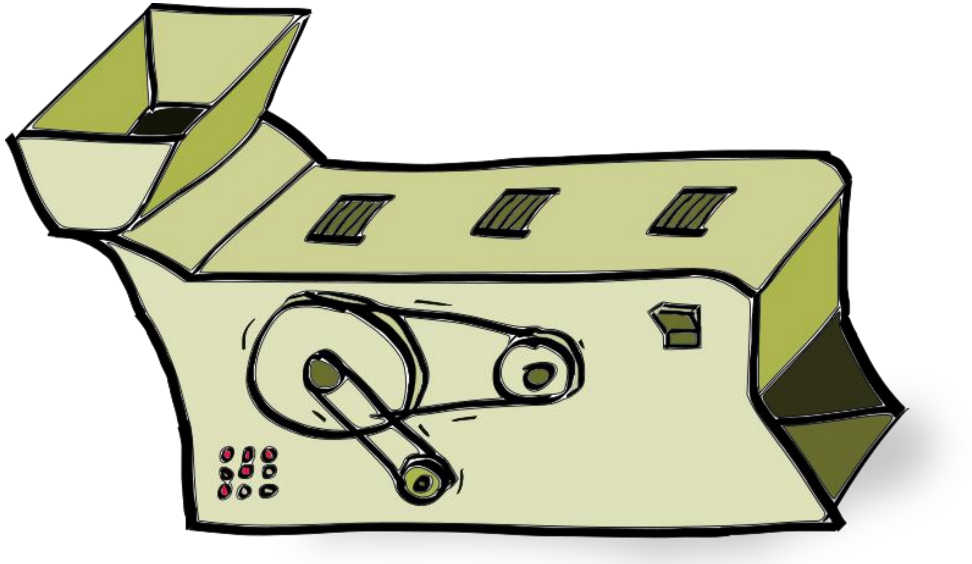


At any given time, a machine is "working", "broken (easy repair)" or "broken (difficult repair)".

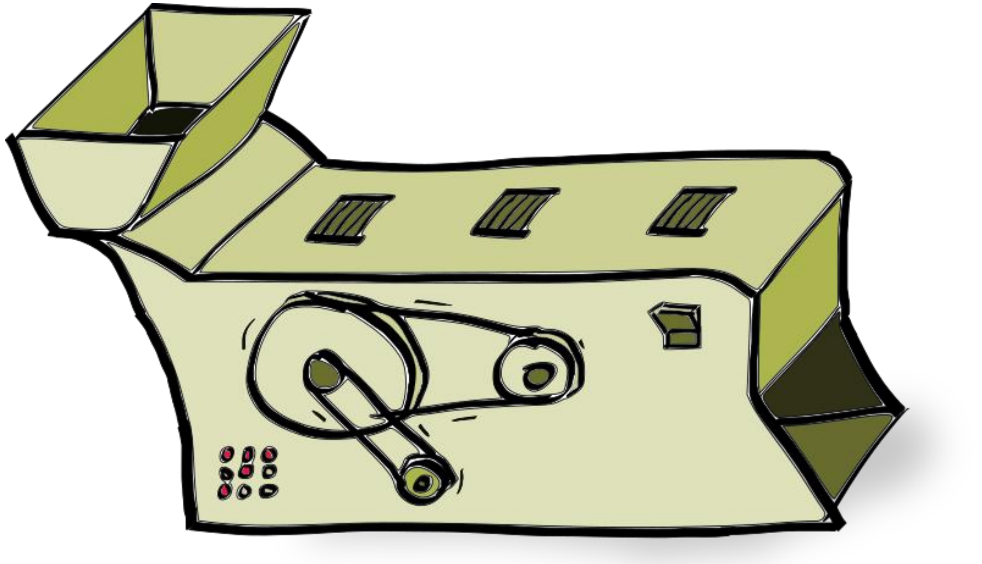
When it breaks, the process moves to "broken (easy repair)" with rate 0.08.

When it breaks, the process moves to "broken (difficult repair)" with rate 0.02.

If broken (difficult repair), it takes an exponentially distributed number of days to fix, with mean 2 days.
If broken (easy repair), it takes an exponentially distributed number of days to fix, with mean 1 days.

1. Draw a state space diagram for this process.
2. What is the distribution of time for which the process remains working? Exponential(0.1)
3. Compute the transition matrix of the jump chain.

0.08+0.02



Let X_t denote the status of a machine at time t and suppose that $\{X_t;\ t \geq 0\}$ is a continuous time Markov process.

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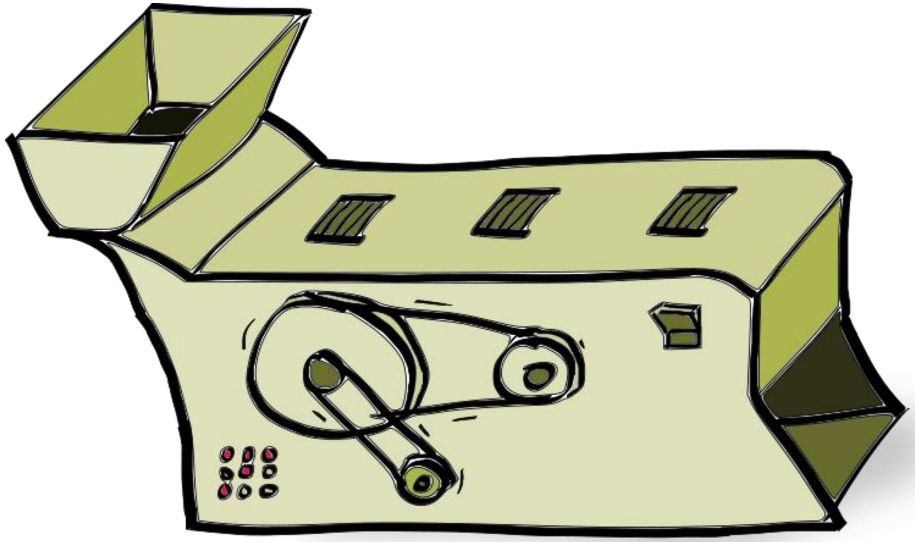

When it breaks, the process moves to “broken (easy repair)” with rate 0.08.

When it breaks, the process moves to “broken (difficult repair)” with rate 0.02.

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If broken (easy repair), it takes an exponentially distributed number of days to fix, with mean 1 days.

State space is {Working, Easy Repair, Difficult Repair}

$$P = \begin{pmatrix} 0 & ? & ? \\ ? & 0 & ? \\ ? & ? & 0 \end{pmatrix} \longrightarrow P = \begin{pmatrix} 0 & 0.08/0.1 & 0.02/0.1 \\ ? & 0 & ? \\ ? & ? & 0 \end{pmatrix} \longrightarrow P = \begin{pmatrix} 0 & 0.8 & 0.2 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}$$

CHECK! Proper transition matrix!