

# Dependent Probabilistic Real-Time

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# Probabilistic Real-Time

## Probabilistic Real-Time System

A probabilistic real-time system is a real-time system with at least one parameter described by a random variable.

The joint probability of  $\mathcal{X}$  and  $\mathcal{Y}$  as the probability of events defined in terms of both  $\mathcal{X}$  and  $\mathcal{Y}$ ,  $\mathbb{P}\{\mathcal{X} = x \text{ and } \mathcal{Y} = y\} =$

$$\mathbb{P}\{\mathcal{Y} = y \mid \mathcal{X} = x\} \cdot \mathbb{P}\{\mathcal{X} = x\} = \mathbb{P}\{\mathcal{X} = x \mid \mathcal{Y} = y\} \cdot \mathbb{P}\{\mathcal{Y} = y\}$$

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## Probabilistic Real-Time System

A probabilistic real-time system is a real-time system with at least one parameter described by a random variable.

Two random variables  $\mathcal{X}$  and  $\mathcal{Y}$  are independent if they describe two events such that the outcome of one event does not have any impact on the outcome of the other.

## Independency

$$\mathbb{P}\{\mathcal{X} = x \text{ and } \mathcal{Y} = y\} = \mathbb{P}\{\mathcal{X} = x\} \cdot \mathbb{P}\{\mathcal{Y} = y\}$$

**CONVOLUTION - probabilistic real-time analysis**

# Dependencies

Dependencies...

- Execution Time and Period (inter-arrivals)?
- among tasks
- among system elements

# Dependent Probabilistic Real-Time

Characterize the dependencies...

- What is a “dependent” task model that can be applied?
- How to model dependencies among tasks and task parameters?

**An attempt - “forgetting” about dependencies**

**Another attempt - “Copula + Real-Time Analysis” as a way of bounding dependencies among tasks**

- which is an accurate model of the task dependencies?
- Is it possible to take into account dependencies in the random variable distribution representation?
- How do we ease the applicability of copulas or alternative dependency representations?