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Exercise for the lecture
Embedded Systems
Wintersemester 17/18

Written Exercise Sheet 7

Hints: These assignments will be discussed at E23 OH14, from 10:15 am - 11:45 am on 30. Jan. 2018. You are not obligated to turn in the solutions.

1 Reliability

- Suppose your smartphone has a problem: once per night you cannot use it because it is blocked for some unknown reason for 30 secs after midnight. So, the rate of these problems is once per 24 hours. Should this rate be called fault-rate, error-rate, or failure-rate? Explain your result!
- Consider a car which runs 364 days per year without any problems, but once a year it needs 1 day for repairs. What is the general equation for computing the availability? What is the result for the average availability of the car? We assume all years are exactly 365 days long.
- Suppose that experimental data confirms the assumption that a particular car breaks at a constant rate. Which distribution would you then assume for the faults?
- What is the propability density in the case of exponentially distributed random events?

2 Simulations, Emulations, and Formal Verifications

How do you define simulations, emulations, and formal verifications of a cyber-physical system? Discuss their differences. If possible, you should use one concrete example.

3 Feasibility of Systems

Is it reasonable to use the following definition: "A system is feasible if $\alpha^u(\Delta) \leq \beta^l(\Delta)$ for any $\Delta \geq 0$", where α and β are arrival curve and service curve, respectively? Explain your answer.

4 TDMA

Consider a TDMA bus having a maximum transfer rate of b bytes per second. Suppose that the bus is allocated with a period of p. Within each period, each of n communcating partners gets $\frac{p}{n}$ seconds of communication time. How do the service curves look like?

5 Processing Power Reduction

Consider a processor with a performance of up to b Operations per second. Let us assume that cache conflicts can reduce this performance to b'. Please demonstrate the corresponding service curves!

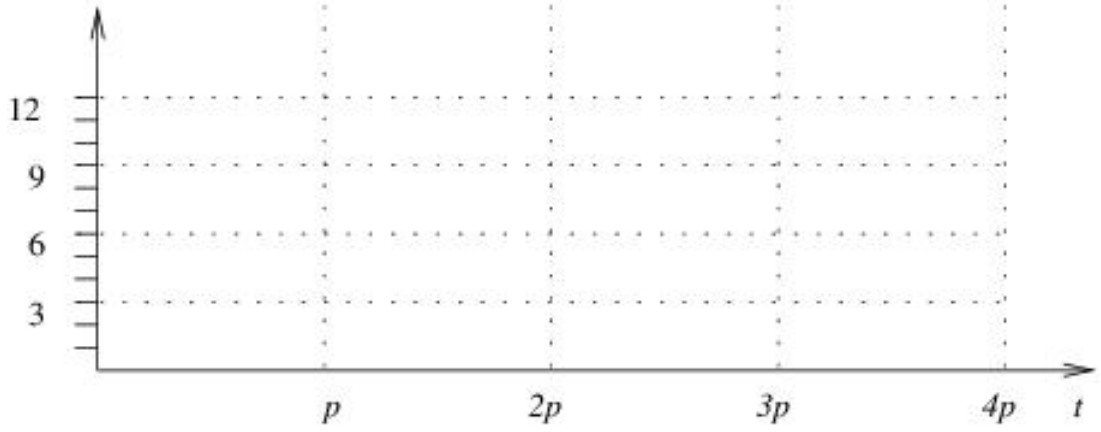
6 Arrival Curves

Consider a stream of events with the following arriving pattern:

- At time $k \cdot p$, two events arrive at the same time, $\forall k \in \{0,1,2,3,\ldots\}$
- At time $k \cdot p + d$, an event arrives, $\forall k \in \{0,1,2,3,\ldots\}$.

The constants p and d are both given, in which $0 < d < p$. How do the arrival curves look like? Demonstrate arrival curves for an interval $[0..3p]$.

Case 1: $d \leq 0.5p$



Case 2: $d > 0.5p$