PCTL

Exercise 1.1. Translate the following PCTL formulae to English

1. $send \implies P_{\geq 0.95} \left[ F \leq 10 \text{ deliver} \right]$
2. $P_{\leq 0.05} \left[ F \frac{err/total}{total} > 0.1 \right]$
3. $P=? \left[ F \leq t \text{ reply\_count} = k \right]$

Exercise 1.2. Translate the following specifications into PCTL formulae

1. The system with two processes satisfy mutual exclusion almost surely ($crit_i$ holds if process $i$ is in the critical section)
2. The probability that every request will eventually be granted with a probability greater than 0.95, is 0.99.
3. The probability that component B fails before component A is less than 0.4
4. If the system is not operational, it almost surely reaches a state from which it has a greater than 0.99 chance of staying operational for 100 time units.

Exercise 2. Check whether the following PCTL formulae hold on the DTMC in Figure 1

- $P_{>0.8}[\neg a \cup FGb]$
- $P_{>0.8}[\neg a \cup \leq 3 Gb]$
- $P_{>0.8}[\neg a \cup b]$
PLTL

Exercise 3. Formalize the following specifications as PLTL formulae. You are free to make reasonable assumptions regarding the atomic propositions.

1. With probability 1, the server always eventually returns to a ready-state
2. With probability at most 0.01, an irrecoverable error occurs

Figure 2: DTMC for PLTL Exercise

Exercise 4.1. Draw Rabin automata for the following LTL formulae: $\phi = G\neg b \land GFa$.

Exercise 4.2. Check whether PLTL formula $\phi$ holds on the DTMC in Figure 2.