CARLETON UNIVERSITY
SCHOOL OF COMPUTER SCIENCE
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COMP 5005 **Assignment III** **Due Feb. 22, 2021**

Consider the following 2-action automaton:

The automaton has three states $\{\phi_i \mid i=0,1,2\}$.

The automaton has two actions $\{\alpha_i \mid i=1,2\}$.

The F function is defined as follows:

(i) If the automaton is in ϕ_i (i=1,2), on being rewarded it stays in ϕ_i with probability 'b'. It goes to ϕ_j ($j \neq i$) with a probability 'a', and goes to ϕ_0 otherwise.

(ii) If the automaton is in ϕ_0, on being rewarded it stays in ϕ_0 with probability 'a' and goes to ϕ_i (i=1,2) with equal probability, otherwise.

(iii) If the automaton is in ϕ_i (i=1,2), on being penalized it goes to ϕ_j ($j \neq i$) with probability 'b', stays in ϕ_i with a probability 'a', and goes to ϕ_0 otherwise.

(iv) If the automaton is in ϕ_0, on being penalized it stays in ϕ_0 with probability 'b' and goes to ϕ_i (i=1,2) with equal probability otherwise.

The G function is defined as follows:

If the automaton is in state ϕ_i (i=1,2) it chooses action α_i with probability 1. If it is in ϕ_0 it chooses both the actions with probability 0.5.

(a) Describe the automaton pictorially and using the F^0, F^1 and G matrices.

(b) Describe an equivalent automaton for which the output matrix is deterministic. (Does this machine have to have 6 states???) Note that you must define the new machine, by specifying its states, and its F and G functions. Do this by describing the automaton pictorially and using matrices.

(c) Write down the $F^{\sim}$ matrix of the old automaton with 'a'=0.2 and 'b'=0.7, when it interacts with an environment (0.4, 0.6). If $\Pi(0) = [0.2, 0.4, 0.4]$, what are $P(0)$, $\Pi(1)$ and $P(1)$?

(d) Write down the $F^{\sim}$ matrix of the new automaton under the identical conditions of (c) above. For this machine show that $P(0)$ and $P(1)$ are exactly as in the above case.