

## Randomly Evolving Graphs and Gittins Type Index Theorem

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We consider the following problem: at each moment of discrete time a finite set of independent trials is available, and a Decision Maker (DM) either chooses a specific trial from the available ones, or decides to stop the process. If some trial is chosen then DM receives a reward depending on this trial. As a result of the trial two outcomes can happen. With some probability the process of testing is terminated and with complementary probability the chosen trial becomes unavailable but some random finite set (possibly empty) of new independent trials is added at the next moment to the set of available trials. The probability of termination and the set of new trials depends on the chosen trial. A DM knows the rewards and transition probabilities of all trials. The goal is to select an order of choosing the trials and a stopping time to maximize the expected total reward.

The trials can be considered as edges of the directed forest. We define an index for each trial. In the case when the total number of potential trials is finite, or under some assumptions on the rewards and probabilities of termination in the case of an infinite forest, we prove that the optimal strategy consists of choosing at each moment the trial with maximal positive index among available trials. In the case of finite number of potential trials we give also a recursive algorithm to calculate index starting from leaves.

From one side, the introduced index generalizes the index introduced by L.G.Mitten in 1960. From the other side for some particular case of the forest and of the parameters the model is equivalent to the Multi-Armed Bandit problem with independent arms, and this index is proportional to the known Gittins index.