□ Markov Model:

.A stochastic model describing a sequence of possible events in which the probability of each event depends only on the state attained in the previous event.

Markov Chain:

Named after Andrey Markov, are a mathematical tool for statistical modeling.

- They play a central role in information sciences, among other areas, and are an important tool in modern applied mathematics.
- It is a way to represent a changing set of health states over time, where there is a known probability or rate of transition from one health state to another.
- It is a statistical representation of recurrent events over time that can be incorporated into decision analysis.
- Markov models are useful when a decision

Markov Model

problem involves risk that is continues over time, when the timing of events is important and when important events may happen more than once.

- Markov model assume that a patient is always in one of a finite number of discrete health states, called Markov states.

□ Types of Markov process:

- Markov processes are categorized according to whether the state-transition probabilities are constant over time or not.
- In the most general type of Markov process, the transition probabilities may change over time. For example, the transition probability for the transition from WELL to DEAD consists of two components.
- The first component is the probability of dying from unrelated causes. In general, this probability changes over time because as the

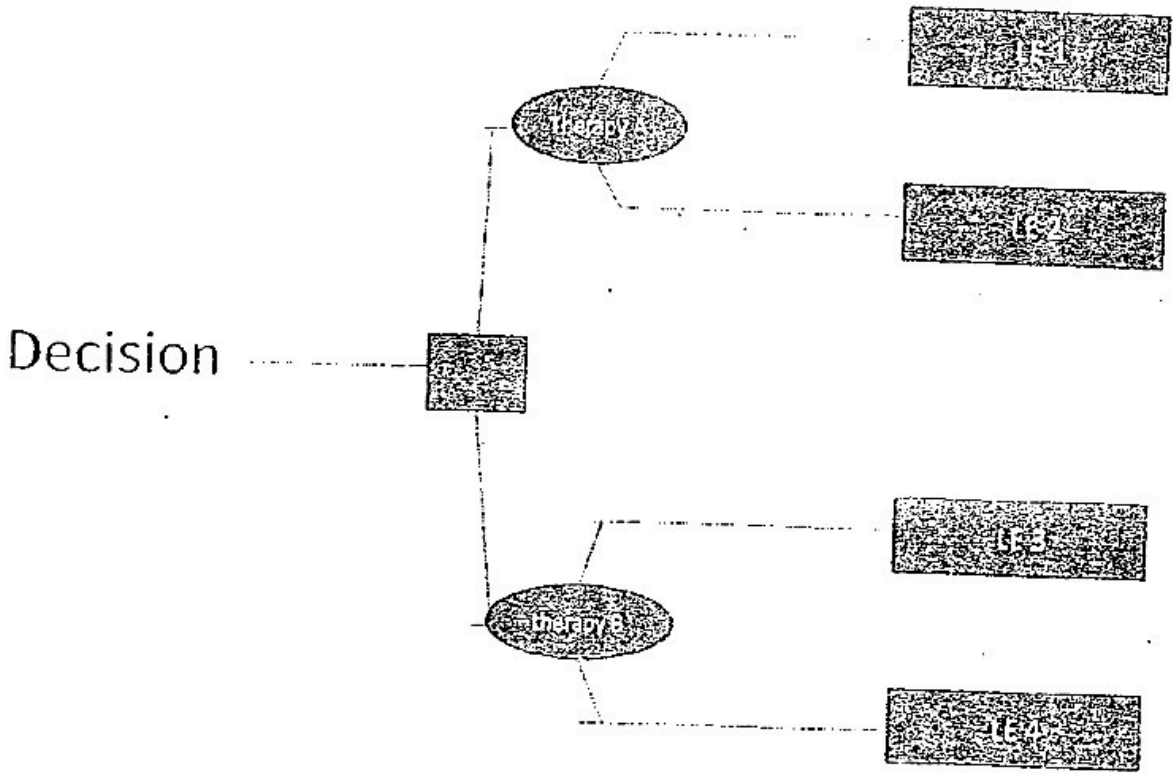
- Maskov Chain:
↳ is a stochastic process with the Markov property.

patient gets older, the probability of dying from unrelated causes will increase continuously.
- The second component is the probability of suffering a fatal hemorrhage or embolus during the cycle. This may or may not be constant over time.

- All events are represented as transitions from one state to another.
- A Markor model may be evaluated by matrix algebra, as a cohort simulation or as a Monte Carlo simulation.
- A newer representation of Markor models, a Markov-cycle tree, uses a tree representation of clinical events and may be evaluated either as a cohort simulation or as a Monte Carlo simulation.
- The ability of the Markov model to represent repetitive events and the time dependence of both probabilities and utilities allows for more

accurate representation of clinical setting that involve these issues.

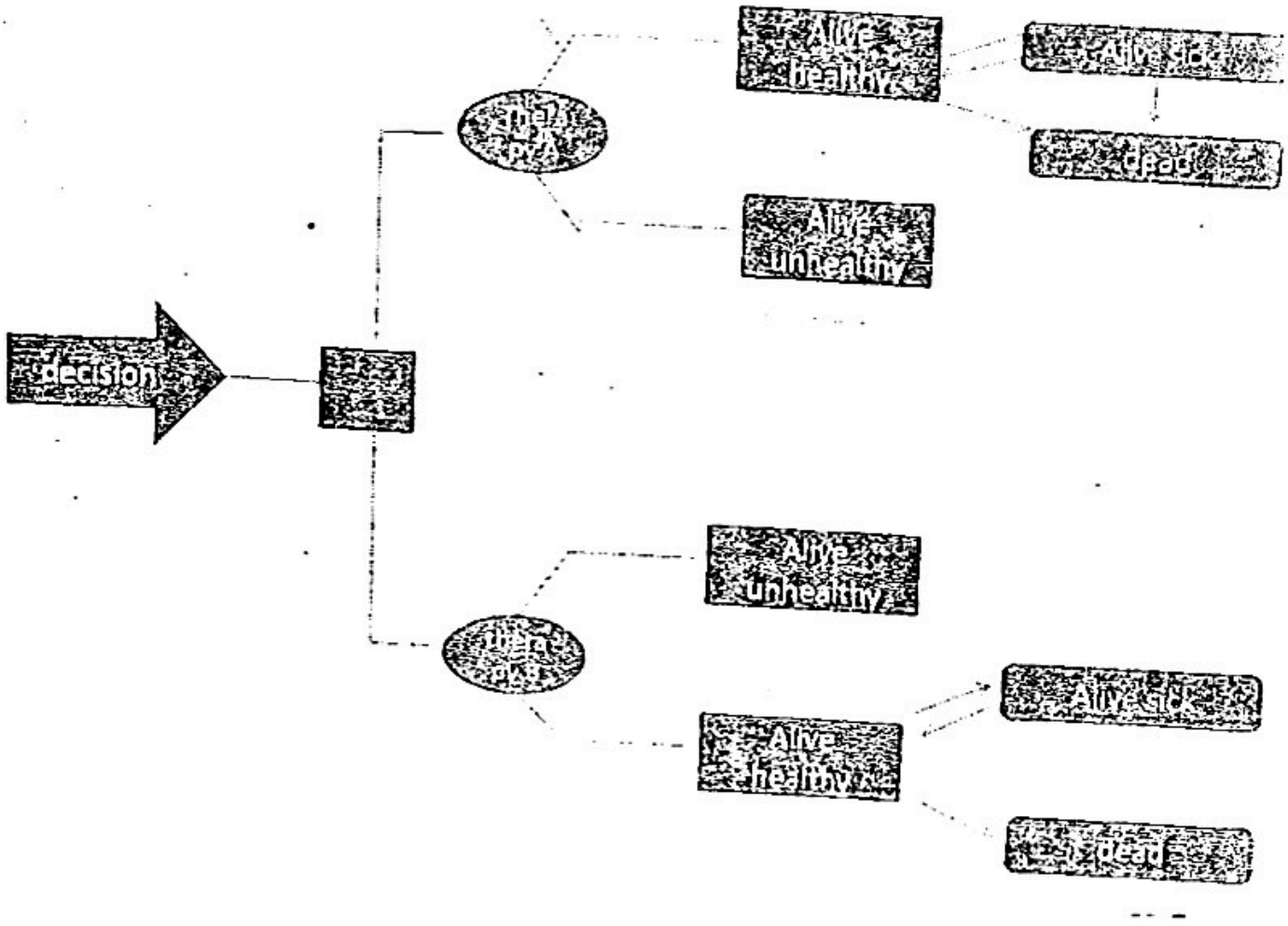
- However, for any model, the outcomes that are expected to occur after each choice are actually complex combination of events that happen in the lives of people proceeding down that path.
- In traditional decision tree the terminal nodes are all single outcomes.
- For eg: the value of the outcome might be measured as life expectancy and QALY or a cost.
- When models must consider events that occur over time or events that may recur in time, the traditional branch and node structure is an inefficient method for presenting this events.



As illustrated in the figure a simple decision tree would terminate in single values such as life expectancy (امید).

- Life expectancy is actually determined by the average life histories of many people who would proceed down that choice .

- This can be presented as seen in next figure by replacing a single LE value with Markov process that represents the events , the modeler wants to detect , that occur after the decision is made and certain outcomes occur



- A Markov process is simply a mathematical representation of the health state in which a patient might find him or herself and likelihood of transitioning between these states .
- The Markov process itself when it is evaluated , calculate the average life expectancy of a cohort proceeding through the Markov process .