6.3. Making Decisions using Probability and Utility

A. Basic Principle of Decision Theory:

Maximization of expected utility

- Calculation of expected utility:

$EU(A|E) = \Sigma_i P(\text{Result}_i(A) \mid E, Do(A)) * U(\text{Result}_i(A))$, where

$\text{Result}_i(A)$ – ith possible outcome state of action A,

E – evidence in the form of current state,

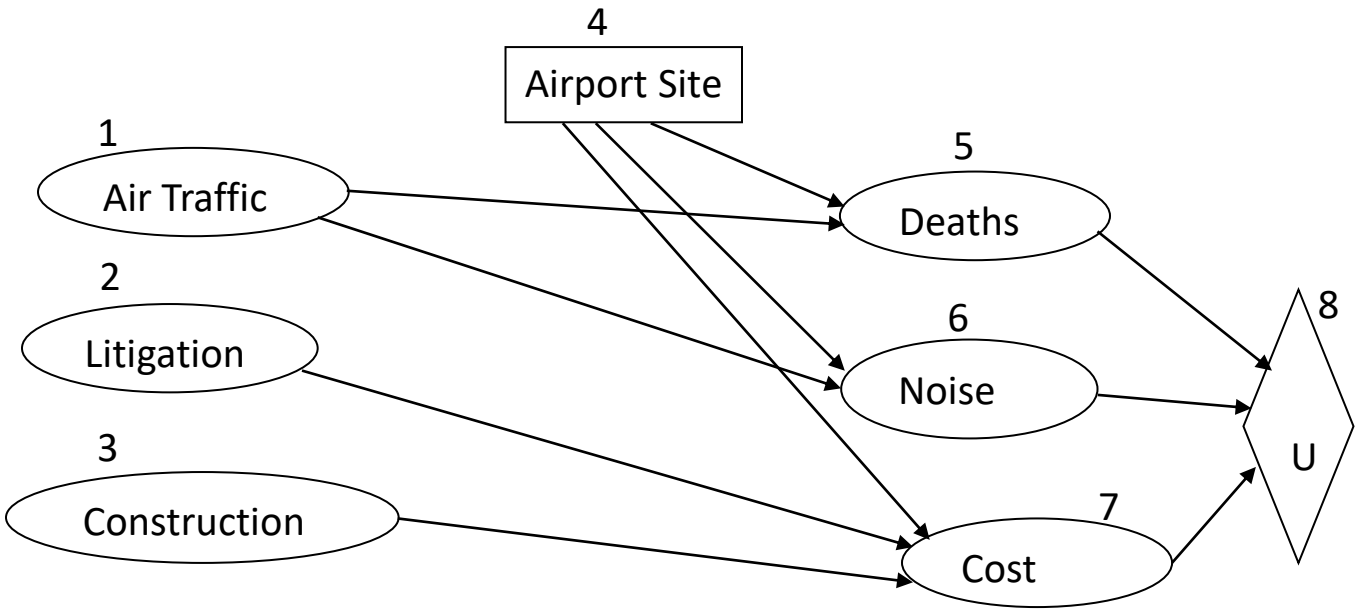
Do(A) – 'Action A is executed in the current state',

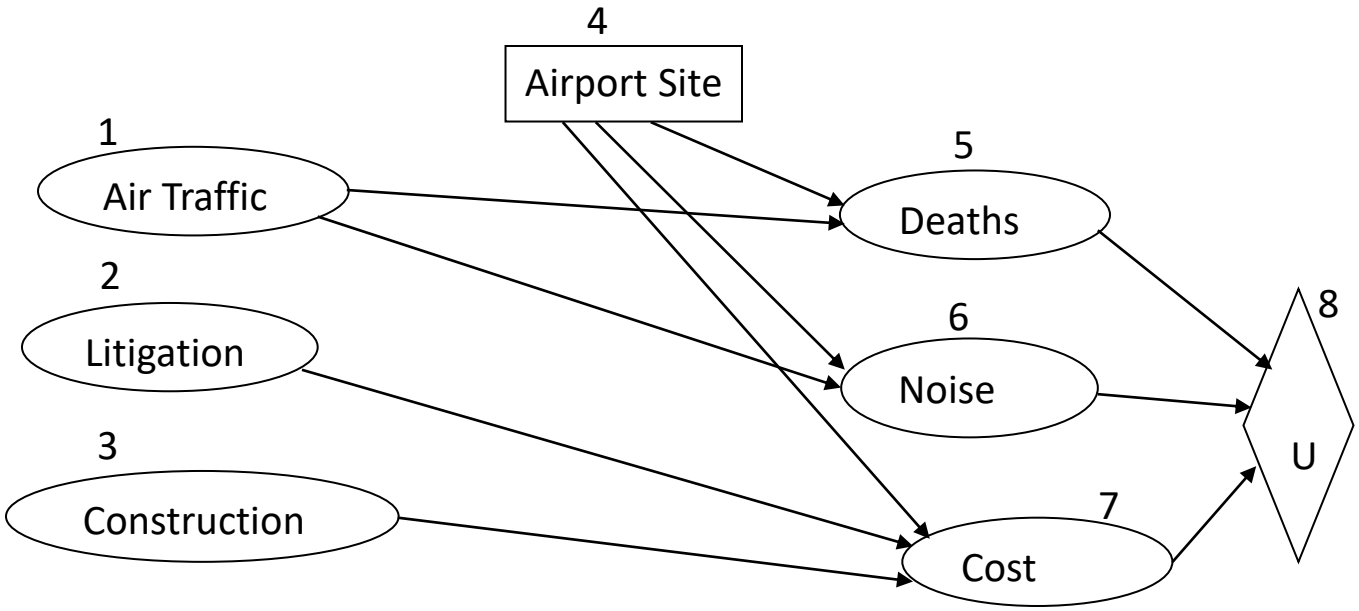
U(S) – Utility of state S.

[A decision theoretic agent has to work with inadequate information. It combines its belief taken as probability and desire taken as utility to assess the outcomes of an action.]

B. Decision Networks for Making Simple Decisions

- A decision network is an extended Bayesian network.
- Decision networks are also called influence diagrams.
- An example: **Airport Siting Problem**





Three types of nodes in a Decision Network:

i) Chance Nodes

{1, 2, 3, 5, 6, 7}; Agent is uncertain at these points; Stand for Random variables.
{1, 2, 3} – current state; {5, 6, 7}- future state

ii) Decision Nodes

{4}; Agent has alternatives at these places; After choosing one it becomes a Chance node; May be more than one Decision nodes in a network.

iii) Utility Node

8; Represents the Utility function of the agent; One node for a network.