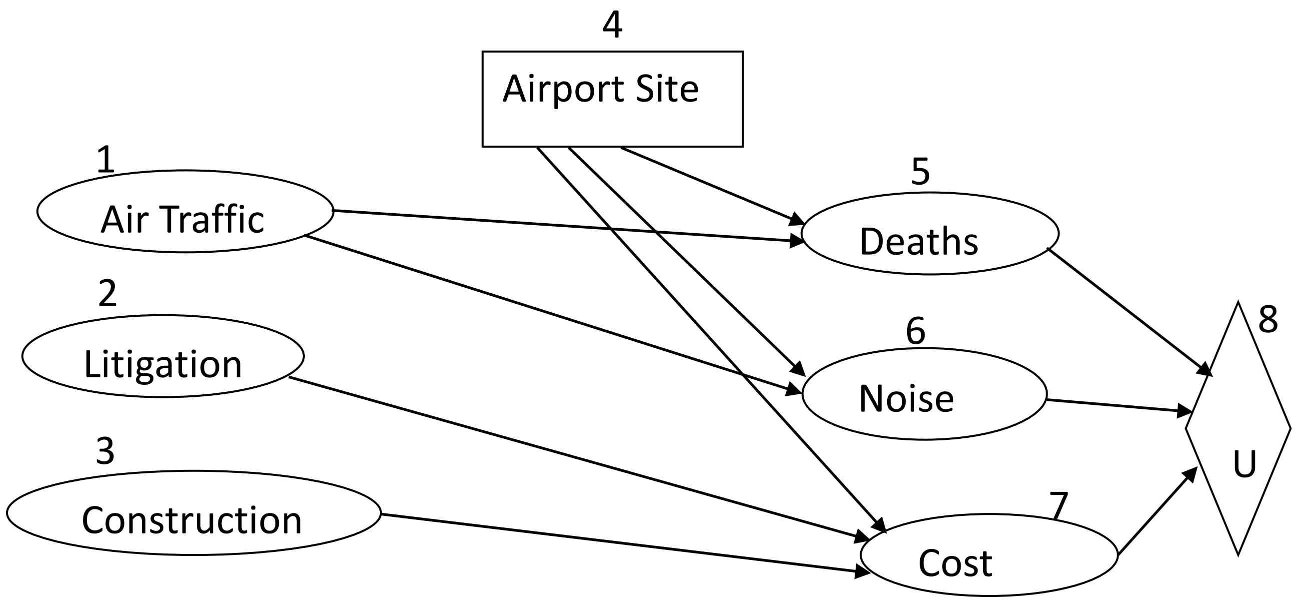
C. Evaluation of Decision Networks

➢ Let's look back at the previous network.



a) Setting Current State

1) Air Traffic

T	P(T)
h	**0.6**
l	0.4

h- high
l- low

2) Litigation

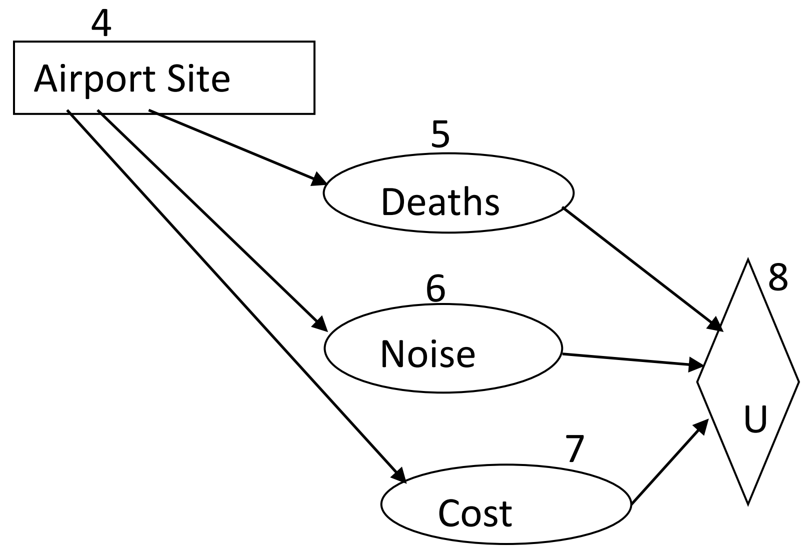
L	P(L)
h	0.7
l	**0.3**

3) Construction

C	P(C)
h	**0.65**
l	0.35

[Say, the current state has been set to T = h, L = l, C = h.]

b) Setting Site Factor, say, for Site S_1



4. Airport Site

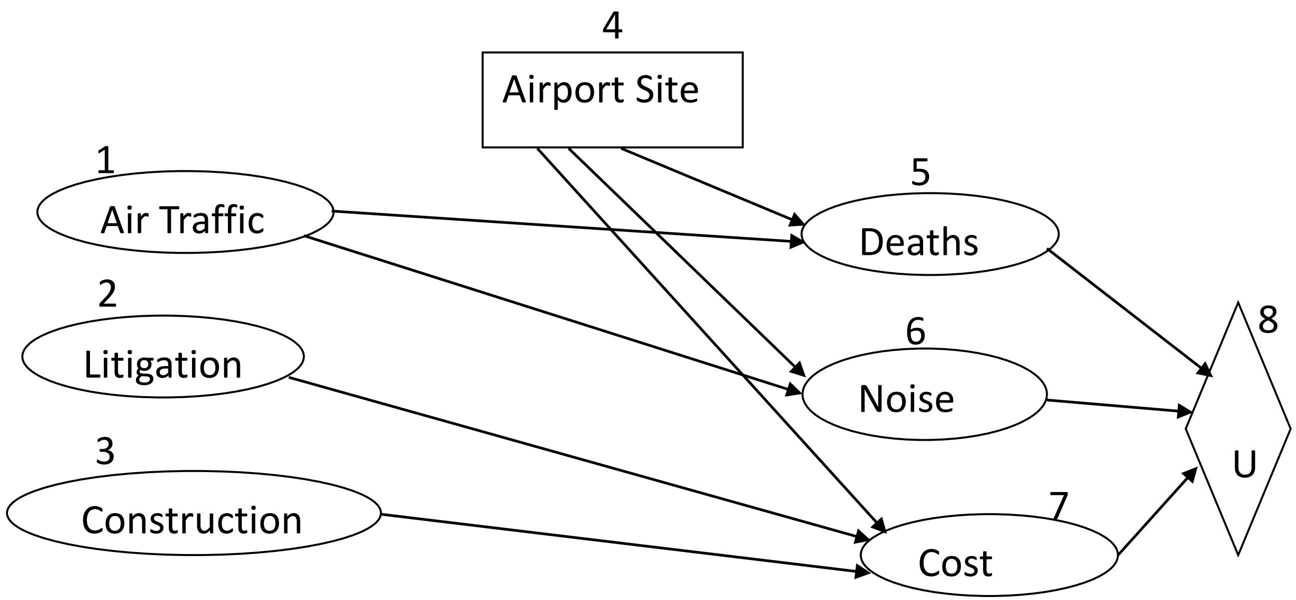
S	P(S)
n	**0.75**
f	0.4

n – near
f - far

P(S) may differ from Site to Site; And influences nD , nN, … may also differ for the same Site.

[Say, for S_1, S = n.]

c) Finding Future State for Site S_1



5. Deaths

T	S	P(deaths)
h	**n**	**0.6**
h	f	0.4
l	n	0.4
l	f	0.1

6. Noise

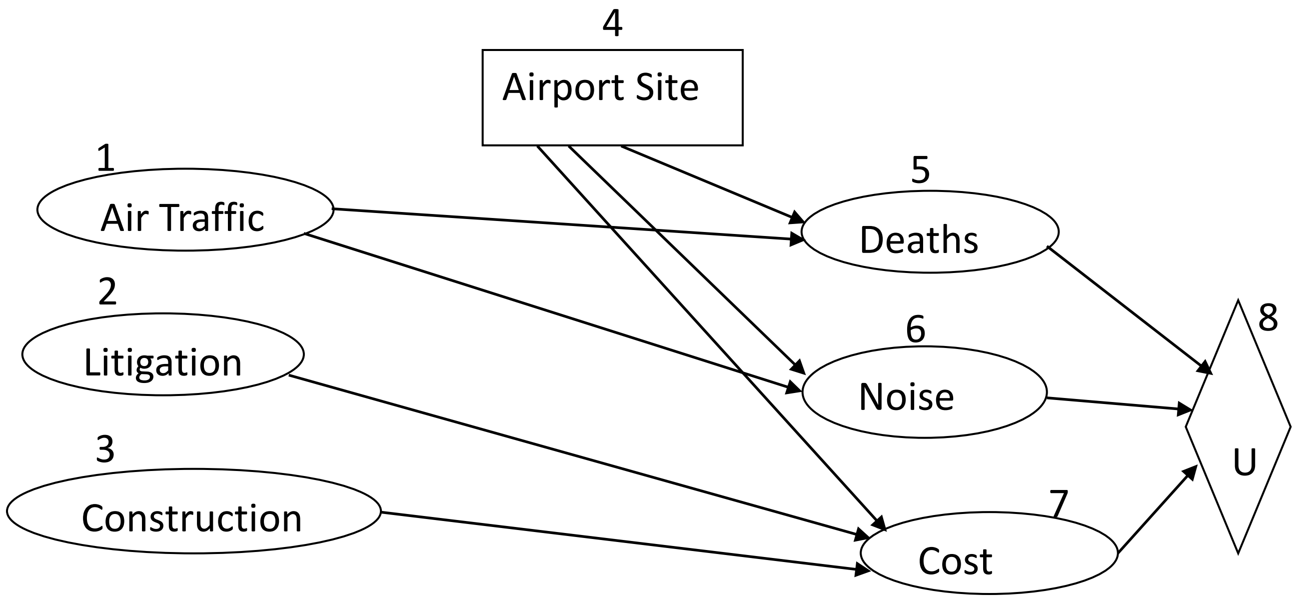
T	S	P(noise)
h	**n**	**0.9**
h	f	0.3
l	n	0.6
l	f	0.01

7. Cost

S	L	C	P(cost)
n	h	h	0.98
n	h	l	0.85
n	**l**	**h**	**0.92**
n	l	l	0.82
f	h	h	0.80
f	h	l	0.45
f	l	h	0.60
f	l	l	0.20

Say, Deaths takes values, deaths (high death risk) and ¬deaths (low death risk), and so on, like ¬cost (low cost).

d) Computing probability factors for utility function, [say, deaths_f, noise_f, cost_f] using joint probabilities:



- ○ P(deaths | (T=h) ∧ (S=n) ∧ (L=l) ∧ (C=h))
- ○ P(noise | (T=h) ∧ (S=n) ∧ (L=l) ∧ (C=h))
- ○ P(cost | (T=h) ∧ (S=n) ∧ (L=l) ∧ (C=h))

✓ P(deaths ∧ (T=h) ∧ (S=n) ∧ (L=l) ∧ (C=h)) / P((T=h) ∧ (S=n) ∧ (L=l) ∧ (C=h))

.....

✓ $P(\text{deaths} \wedge (T=h) \wedge (S=n) \wedge (L=l) \wedge (C=h)) \; / \; P((T=h) \wedge (S=n) \wedge (L=l) \wedge (C=h))$

$P(\text{deaths} \wedge (T=h) \wedge (S=n) \wedge (L=l) \wedge (C=h) \wedge \text{noise} \wedge \text{cost})$ +
$P(\text{deaths} \wedge (T=h) \wedge (S=n) \wedge (L=l) \wedge (C=h) \wedge \text{noise} \wedge \neg\text{cost})$ +
$P(\text{deaths} \wedge (T=h) \wedge (S=n) \wedge (L=l) \wedge (C=h) \wedge \neg\text{noise} \wedge \text{cost})$ +
$P(\text{deaths} \wedge (T=h) \wedge (S=n) \wedge (L=l) \wedge (C=h) \wedge \neg\text{noise} \wedge \neg\text{cost})$.

For example,
$P(\text{deaths} \wedge (T=h) \wedge (S=n) \wedge (L=l) \wedge (C=h) \wedge \text{noise} \wedge \text{cost})$
$= P(\text{deaths} \mid (T=h) \wedge (S=n)) * P(T=h) * P(S=n) * P(L=l) * P(C=h) * P(\text{noise} \mid (T=h) \wedge (S=n)) * P(\text{cost} \mid (S=n) \wedge (L=l) \wedge (C=h))$

$= 0.6 * 0.6 * 0.75 * 0.3 * 0.65 * 0.9 * 0.92 = \ldots$

e) Computing utility function:

$U(S_1) = -k_1 * \text{deaths\_f} - k_2 * \text{noise\_f} - k_3 * \text{cost\_f}$, for positive constant k_i
Similarly, $U(S_2)$, $U(S_3)$, … .

f) Taking max[$U(S_1)$, $U(S_2)$, $U(S_3)$, …, $U(S_x)$], for number of possible Sites x