decision theory 2

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Question 1

Action

1. Take the train
2. Take the car

States of nature

Train

While taking the train, there are two states:

1. The train is not delayed more than 30 minutes.
2. The train is delayed more than 30 minutes.

The probability of states1 can be calculated by

$$\int_0^{30} (45 - x) * 0.001 \ dx = 0.9$$

So,

1. The train is not delayed more than 30 minutes with 0.9 probability.
2. The train is delayed more than 30 minutes with 0.1 probability.

Car

While taking the train, generally there are two states:

1. The car can arrive the airport in time.
2. The car can not arrive the airport in time.

For the first states, we can get the probability by

$$0.99 * \int_0^{75} (90 - x) * 0.0002 \ dx = 0.78$$

The second states can be divided into these parts, and it's also easy to calculate the probability:

1. The car is delayed more than 75 mins but no accident 0.21
2. The car is involved in an accident but no extra help needed 0.005
3. The car is involved in an accident but only need medical care 0.004
4. The car is involved in an accident and results in death or going to hospital 0.001.

Summary everything above

Table 1 : taking the train

State of nature	**Consequence**
Arrive in time	Catch the flight
Arrive late	Miss the flight

Table 2 : taking the car

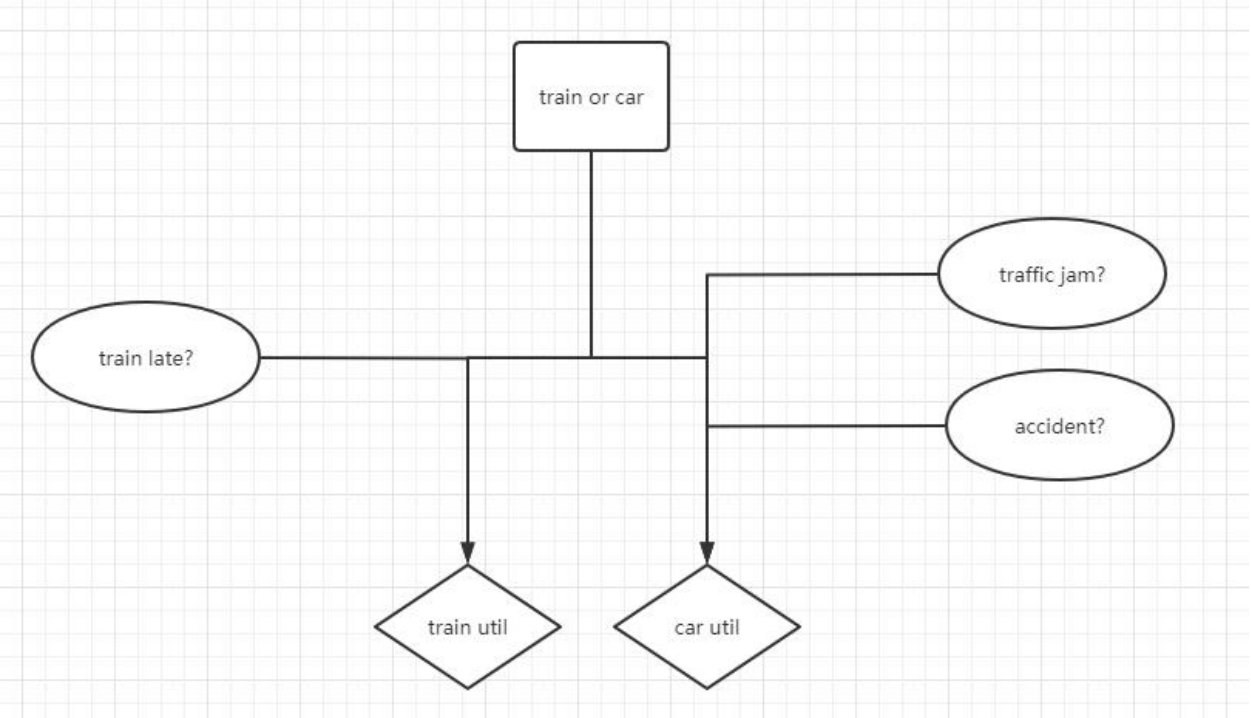
State of nature	**Consequence**
Arrive in time	catch the flight
No accident, Arrive late	Miss the flight
Accident, no extra help needed	Miss the flight, repair car
Accident, need medical care	Miss the flight, repair car, time for medical care
Accident, hospital or death	Miss the flight, repair car, hospitalization/funeral

Question 2

It is possible to view this as one single decision problem. For each action, we can time the probability of consequence and the corresponding cost, then sum them together. In this way, we can know which action is better.

Question 3

We can define the problem like below



$$EU(train) = -50 * 0.9 - 350 * 0.1 = -80$$

For $EU(car)$, we need to define the cost of some consequence. We assume such a table

consequence	cost
accident medical care	500
accident hospital/death	1000

Then we can calculate

$$EU(car) = -70 * 0.78 - 370 * 0.21 - 370 * 0.005 - 500 * 0.004 - 1000 * 0.001 = -137.15$$

In this case, we should take the train.