Part 4: Utility

1. Which route should we pick?

Calculations for all routes:
What we know: 0.2, 0.3, 0.5, 5 km/h,
Sandy = 3 km/h = 20 min per km
Rocky = 2 km/h = 30 min per km
Smooth = 5 km/h = 12 min per km

Route 1:
time = (0.2 x 20) + (0.3 x 12) + (0.5 x 30) =
4 + 3.6 + 15 = 22.6 minutes
22.6 x 5 = 113 minutes

Route 2:
time = (0.4 x 20) + (0.2 x 12) + (0.4 x 30) =
8 + 2.4 + 12 = 22.4 minutes
22.4 x 7 = 156.8 minutes

Route 3:
time = (0.5 x 20) + (0.4 x 12) + (0.1 x 30) =
10 + 4.8 + 3 = 17.8 minutes
17.8 x 6 = 106.8 minutes

Route 3 is the fastest

2. Added Obstacles

Route 1 (crater):
new_time = (0.3 x 15) + (0.7 x -20) =
4.5 - 14 =
-9.5 minutes
113 - 9.5 = 103.5 minutes

Route 3 (Bridge)
new_time = (0.6 x 40) + (0.4 x 0)
24 + 0

→ We should not wait for the satellite because the benefit of waiting is not faster than taking route 1

106.8 + 24 = 130.8

Route 1 is the fastest at 103.5

3. If Route 2 is not rocky what is the expected time?

If it is not rocky then it is either sandy or smooth.
Sandy: 0.4/0.4+0.2 = 0.4/0.6 = 0.6667
Smooth: 0.2/0.4 + 0.2 = 0.2/0.6 = 0.333

time = (0.667 x 20) + (0.333 x 12)
= 13.334 + 4
= 17.334 x 7 = 121.338 minutes
The satellite confirms that Route 2 is not rocky, we would expect it to take 121.338 minutes

4. What is the probability that the satellite will tell us this?
Route 2: rocky 40%
Not rocky: 1 - 0.4 = 0.6
60% probability that will confirm Route 2 is not rocky

5. If the satellite confirms that Route 2 is rocky we can use the original time of 156.8 minutes, since we also include rocky terrains

6. Given this, how long should we wait for the satellite

Route 2 is rocky = 0.4
Route 2 is not rocky = 0.6

We know that not rocky travel time is 121.338 and rocky is 156.8

(0.6 x 121.338) + (0.4 x 156.8)
= 72.8028 + 62.72
135.524 minutes