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CS 386
Assignment 5

Part 1:

Minutes per kilometer:

- Rocky terrain -
 $60/2 = 30 \text{ min/km}$
- Sandy terrain -
 $60/3 = 20 \text{ min/km}$
- Smooth terrain -
 $60/5 = 12 \text{ min/km}$

Route 1:

Probability of sandy terrain: 20% $\rightarrow 0.2$

Probability of smooth terrain: 30% $\rightarrow 0.3$

Probability of rocky terrain: 50% $\rightarrow 0.5$

$$(0.2 \times 20) + (0.3 \times 12) + (0.5 \times 30) = 4 + 3.6 + 15 = 22.6 \text{ min/km}$$

$$22.6 \times 5 = 113 \text{ min}$$

Route 2:

Probability of sandy terrain: 40% $\rightarrow 0.4$

Probability of smooth terrain: 20% $\rightarrow 0.2$

Probability of rocky terrain: 40% $\rightarrow 0.4$

$$(0.4 \times 20) + (0.2 \times 12) + (0.4 \times 30) = 8 + 2.4 + 12 = 22.4 \text{ min/km}$$

$$22.4 \times 7 = 156.8 \text{ min/km}$$

Route 3:

Probability of sandy terrain: 50% $\rightarrow 0.5$

Probability of smooth terrain: 40% $\rightarrow 0.4$

Probability of rocky terrain: 10% $\rightarrow 0.1$

$$(0.5 \times 20) + (0.4 \times 12) + (0.1 \times 30) = 10 + 4.8 + 3 = 17.8 \text{ min/km}$$

$$17.8 \times 6 = 106.8 \text{ min/km}$$

Route 3 has the shortest travel time of 106.8 minutes, so the rover should pick that route.

Part 2:

Route 1:

If the crater wall is intact: 70% chance of saving 20 mins

If damaged: 30% chance of adding 15 mins

$$(0.7 \times -20) + (0.3 \times 15) = -9.5 \text{ mins}$$

$$113 - 9.5 = \mathbf{103.5 \text{ minutes}}$$

Route 3:

If the bridge is damaged: 60% of adding 40 mins

If not damaged: 40% of no added time

$$(0.4 \times 0) + (0.6 \times 40) = 0 + 24 = 24 \text{ mins}$$

$$106.8 + 24 = \mathbf{130.8 \text{ minutes}}$$

With this new information, route 1 would be the best choice.

Part 3:

Updated probability for sandy = $0.4/0.6 = 0.667 = 66.67\%$

Updated probability for smooth = $0.2/0.6 = 0.333 = 33.33\%$

1. $7 \times 20 = 140 \text{ minutes}$

$$0.6667 \times 140 = \mathbf{93.34 \text{ minutes for sandy terrain}}$$

2. $7 \times 12 = 84 \text{ minutes}$

$$0.333 \times 84 = \mathbf{28 \text{ minutes for smooth terrain}}$$

$$93.34 + 28 = \mathbf{121.34 \text{ minutes for terrain not rocky}}$$

Part 4:

$$P(\text{Not Rocky}) = P(\text{Sandy}) + P(\text{Smooth}) = 0.4 + 0.2 = 0.6$$

$$P(\text{Not Rocky}) = 60\%$$

Part 5:

1. If Route 2 is not rocky: time = 121.34 minutes

2. If Route 2 is rocky: time = 156.8

$$\text{Time with satellite info} = (0.6 \times 121.34) + (0.4 \times 156.8) = 135.524 \text{ minutes}$$

Route 1 < Time with satellite, so route 1 would be the better option over waiting for the satellite.