Michael H. Smith / CS386

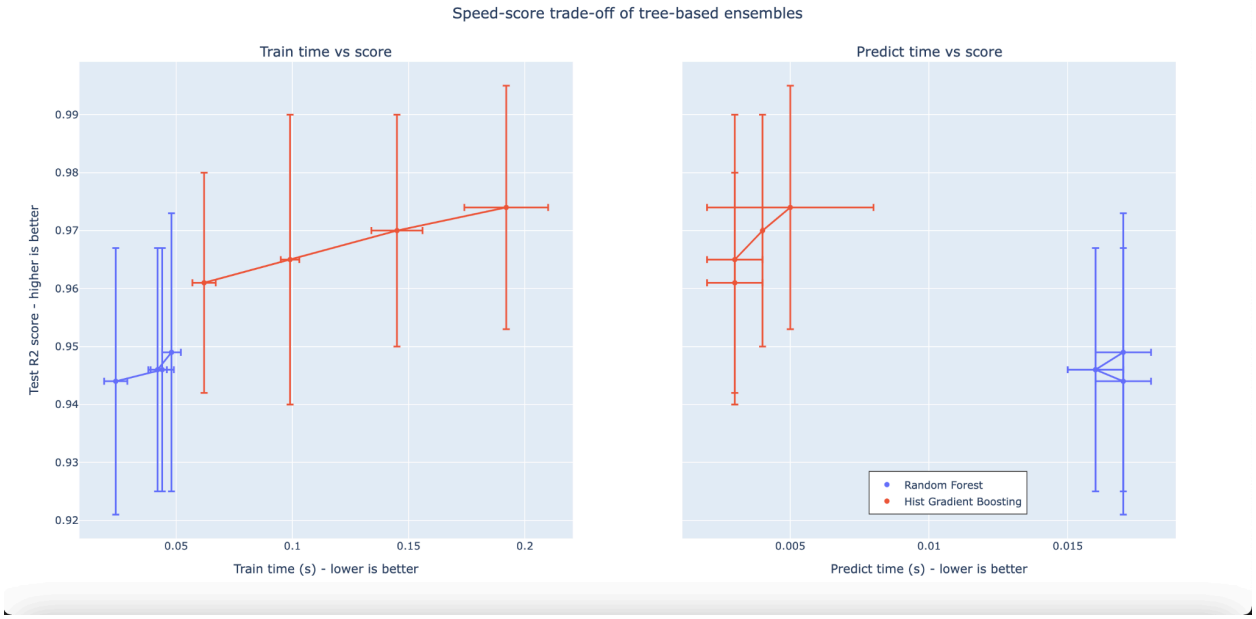
Assignment 5: Working with Uncertainty - Written Work

Question 1:

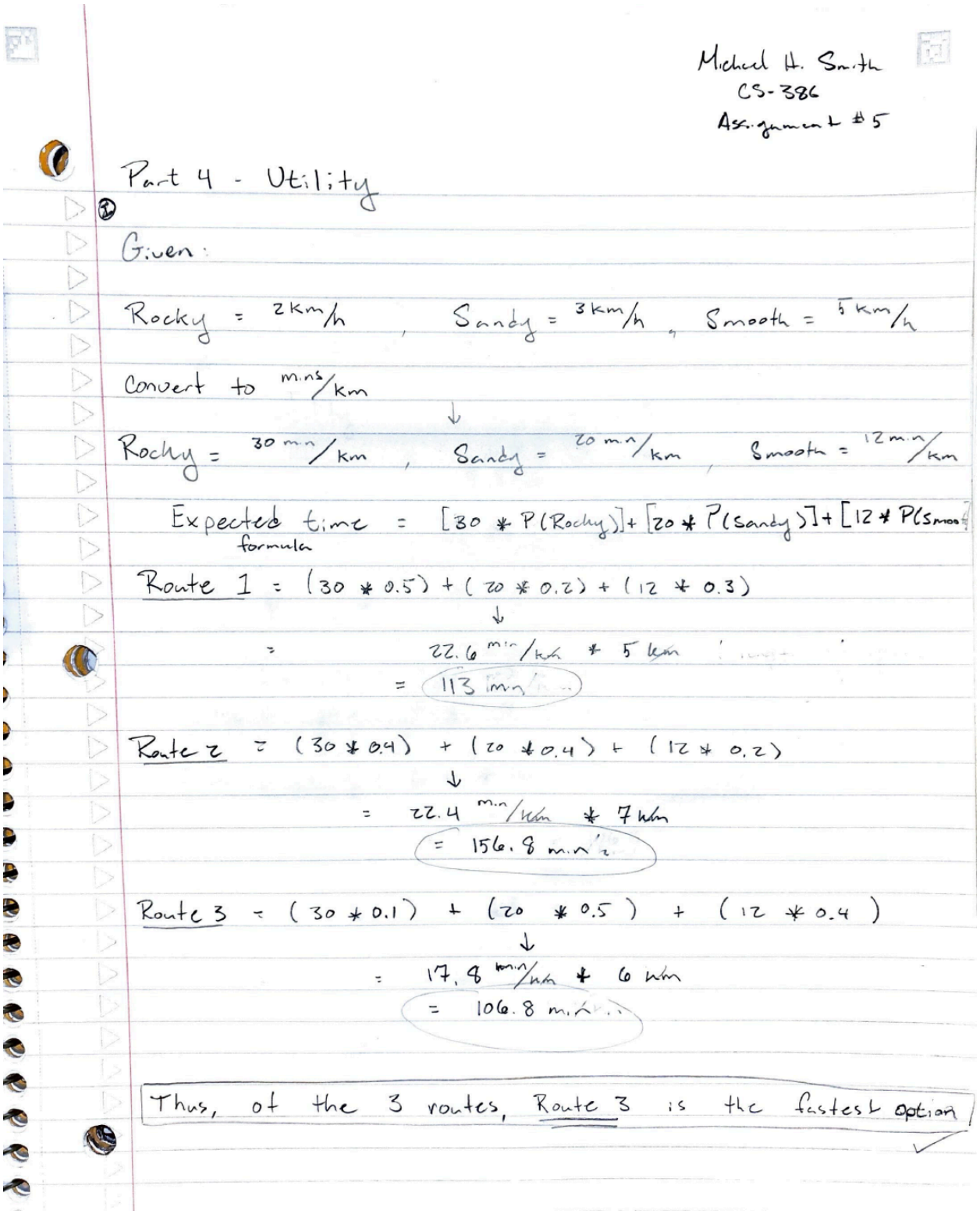
Part 2 - Recall that the Random Forest is an ensemble-based approach uses multiple decision trees. Replace the Decision Tree with the Random Forest Classifier. Run it on your dataset with 10, 25, and 50 estimators using both gini and entropy as separators. Create a table showing the results and add it to the PDF with your written answers:

Estimators	Criterion	Avg. Score
10	gini	0.942028
	entropy	0.950815
25	gini	0.945552
	entropy	0.949076
50	gini	0.952585
	entropy	0.956094

Part 3: - (5 points) The last part shows how to use plotly to generate a scatterplot showing your results. Generate a plot and add it to the PDF with your answers:



Part 4. Utility



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Part 4 - Utility

Given:

Rocky = 2 km/h , Sandy = 3 km/h , Smooth = 5 km/h

Convert to mins/km

↓

Rocky = 30 min/km , Sandy = 20 min/km , Smooth = 12 min/km

Expected time = [30 * P(Rocky)] + [20 * P(sandy)] + [12 * P(Smooth)]
formula

Route 1 = (30 * 0.5) + (20 * 0.2) + (12 * 0.3)

↓

= 22.6 min/km * 5 km

= 113 min

Route 2 = (30 * 0.4) + (20 * 0.4) + (12 * 0.2)

↓

= 22.4 min/km * 7 km

= 156.8 min

Route 3 = (30 * 0.1) + (20 * 0.5) + (12 * 0.4)

↓

= 17.8 min/km * 6 km

= 106.8 min

Thus, of the 3 routes, Route 3 is the fastest option

II

Update Route 1:

P(Shortcut) = 0.7 → − 20 min
P(Delay) = 0.3 → + 15 min

Expected utility = (0.3 * 15) + (0.7 * −20) min
↓
= −9.5 min
= 113 min/km − 9.5 min → = 103.5 min/km

Update Route 3:

P(bridge damage) = 0.6 → + 40 min
P(!bridge damage) = 0.4 → + 0

Expected Utility = (0.6 * 40) + (0.4 * 0) min
↓
= 24 min + 106.8 min/km → = 130.8 min/km

New Route times: Route 1 & 103.5, Route 2: 156.8, Route 3: 130.8
(unchanged)

Thus, Route 1 is now the fastest option ✓

① How long if satellite says "not rocky"?

60% sandy } adjusted probability w/o rocky
40% smooth

Expected time = (0.6 * 20) + (0.4 * 12)
(!Rocky)

= 16.8 min/km * 7 km

= 117.6 min

② What is the probability the satellite will tell us this?

P(!Rocky) = whole - P(rocky)

↓

1 - 0.4 = 0.6

③ If satellite tells us Route 2 is Rocky, what do we do? How long will that take?

- if Route 2 is rocky, expected time = 156.8

156.8 > 130.8 (Route 3) > 103.5 (Route 1) → Choose Route 1

④ How long should we wait for satellite?

P(Rocky) = 40% → expected time = 156.8

P(!Rocky) = 60% (part 2) → expected time = 117.6 min (part 1)

So,

Expected time = (0.4 * 156.8) + (0.6 * 117.6) min
(w/ satellite info.)

↓

≈ 133.3 min

part 4 continued

Thus, being that waiting for the satellite yields an expected time of 133.3 min, we are better of just taking Route 1 or Route 3 as these options are both faster than delaying for satellite updates. ✓