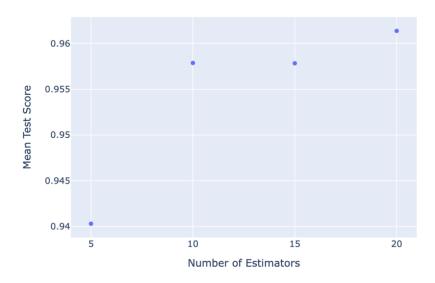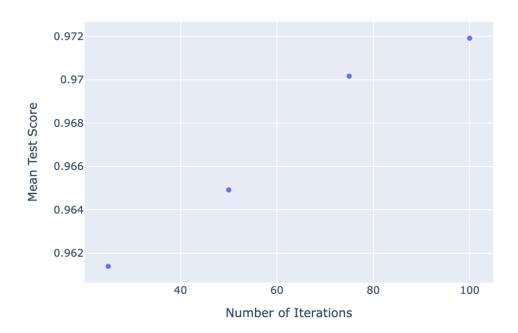| Criterion	Estimators	Average Score
gini	10	0.9603
gini	25	0.9887
gini	50	0.9832
entropy	10	0.983
entropy	25	0.9832
entropy	50	0.9887

Random Forest Performance

Histogram Gradient Boosting Performance

Part 4

1. Convert Speeds to Time per km

We first convert the rover's speed over different terrains into time per kilometer:

- **Rocky Terrain (2 km/h)**:
  Time per km = 60 / 2 = 30 minutes/km
- **Sandy Terrain (3 km/h)**:
  Time per km = 60 / 3 = 20 minutes/km
- **Smooth Terrain (5 km/h)**:
  Time per km = 60 / 5 = 12 minutes/km

2. Expected Travel Time for Each Route

- **Route 1 (5 km):**
  - 20% chance sandy → 20 minutes/km
  - 30% chance smooth → 12 minutes/km
  - 50% chance rocky → 30 minutes/km
    The expected time is:
    Expected Time = (0.2 × 20 × 5) + (0.3 × 12 × 5) + (0.5 × 30 × 5) = 20 + 18 + 75 = **113 minutes**
- **Route 2 (7 km):**
  - 40% chance sandy → 20 minutes/km
  - 20% chance smooth → 12 minutes/km
  - 40% chance rocky → 30 minutes/km
    The expected time is:
    Expected Time = (0.4 × 20 × 7) + (0.2 × 12 × 7) + (0.4 × 30 × 7) = 56 + 16.8 + 84 = **156.8 minutes**
- **Route 3 (6 km):**
  - 50% chance sandy → 20 minutes/km
  - 40% chance smooth → 12 minutes/km
  - 10% chance rocky → 30 minutes/km
    The expected time is:
    Expected Time = (0.5 × 20 × 6) + (0.4 × 12 × 6) + (0.1 × 30 × 6) = 60 + 28.8 + 18 = **106.8 minutes**

3. Updated Travel Time with Special Conditions

- **Route 1 (crater with a 30% chance of damage):**
  - 30% chance the wall is damaged → adds 15 minutes
  - 70% chance the wall is intact → saves 20 minutes
    The expected time is:

Expected Time = (0.3 × (113 + 15)) + (0.7 × (113 - 20)) = (0.3 × 128) + (0.7 × 93) = 38.4 + 65.1 = **103.5 minutes**

- Route 3 (bridge with a 60% chance of damage):
  - 60% chance the bridge is damaged → adds 40 minutes
  - 40% chance the bridge is intact → no added time
    The expected time is:
    Expected Time = (0.6 × (106.8 + 40)) + (0.4 × 106.8) = (0.6 × 146.8) + (0.4 × 106.8) = 88.08 + 42.72 = **130.8 minutes**

4. Best Route Decision

- **Route 1**: 103.5 minutes
- **Route 2**: 156.8 minutes
- **Route 3**: 130.8 minutes

Route 1 is the best choice with an expected time of 103.5 minutes.

5. Satellite Information (Route 2)

The satellite can tell us if Route 2 is rocky, which will change the expected time.

- If Route 2 is not rocky:
  - 40% chance sandy → 20 minutes/km
  - 20% chance smooth → 12 minutes/km
    The expected time is:
    Expected Time = (0.4 × 20 × 7) + (0.2 × 12 × 7) = 56 + 16.8 = **72.8 minutes**
- Probability that Route 2 is not rocky:
  40% sandy + 20% smooth = **60%** (60% chance Route 2 is not rocky).
- If Route 2 is rocky:
  The expected time is the original 156.8 minutes.

6. Should We Wait for the Satellite?

- **If Route 2 is not rocky**: The travel time would be **72.8 minutes**.
- **If Route 2 is rocky**: The travel time would be **156.8 minutes**.

Wait Time Decision:
You should wait for the satellite if you think the chance of a quicker journey (72.8 minutes) is worth the risk of the route being rocky (156.8 minutes). The satellite has a 60% chance of confirming a non-rocky route.