Course: Computing Science

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Subject: Parallel Computing

**Part 1: What will be the best and worst case scenario.**

**The scenario is a metro station of a refugee camp in India for 900 million people.**

**The train only accommodates 1000 people and there are only 4 rails way and 10 trains going, 10 returning**

1. **What will be the best and worst case scenario.**

**Worst case scenario**

**Given the following data:**

Total population: 900 million people

Train capacity: 1000 people per train

Number of rails: 4

Trains: 10 going, 10 returning

**And these assumptions:**

1. Distance to new location: 500 km (Let's assume this as a long-distance relocation)

2. Average train speed: 60 km/h (accounting for stops, loading/unloading)

3. Loading/unloading time: 30 minutes each

4. No mechanical failures or delays (though this is unlikely in a real worst-case scenario)

5. Trains operate 24 hours a day

**Calculations:**

1. **Time for one round trip:**

Travel time: (500 km / 60 km/h) \* 2 = 16.67 hours

Loading/unloading time: 0.5 hour \* 4 (load and unload at both ends) = 2 hours

Total round trip time: 16.67 + 2 = 18.67 hours

2. **Number of people moved per round trip:**

10 trains \* 1000 people = 10,000 people

3. **Number of round trips needed:**

900,000,000 people / 10,000 people per trip = 90,000 trips

4. **Total time needed:**

90,000 trips \* 18.67 hours per trip = 1,680,000 hours

1,680,000 hours / 24 hours per day = 70,000 days

70,000 days / 365 days per year ≈ 191.78 years

**Worst-case scenario analysis:**

1. **Time frame:** It would take **approximately 192 years** to relocate the entire population.

2. **Resource strain:**

Trains would need to operate continuously for nearly two centuries.

Massive ongoing fuel/energy consumption.

Extensive maintenance required to keep trains and tracks operational.

3**. Social impact:**

Multiple generations would be born and die during the relocation process.

Families and communities would be separated for long periods.

Potential for social unrest due to perceived unfairness in relocation order.

4**. Economic impact:**

Enormous cost of operating the trains for such a long period.

Productivity loss due to constant movement of the population.

Challenges in maintaining economic activities at both locations.

**5. Logistical challenges:**

Providing food, water, and sanitation for the waiting population.

Managing health and safety for nearly two centuries in temporary conditions.

Coordinating such a massive movement over such a long time frame.

**6. Environmental impact:**

Long-term environmental degradation along the rail corridor.

Significant carbon emissions from constant train operations.

**7. Infrastructure wear:**

Rails and trains would need frequent replacement, causing additional delays.

This worst-case scenario highlights the extreme inadequacy of the proposed transportation system for the given population size. It underscores the need for either a massively scaled-up transportation solution or a completely different approach to managing such a large population movement.

**Best case scenario**

**Given:**

Total population: 900 million people

Train capacity: 1000 people per train

Number of rails: 4

Trains: 10 going, 10 returning

**Best-case assumptions:**

1. Distance to new location: 100 km (assuming a closer relocation site)

2. Average train speed: 200 km/h (assuming high-speed rail)

3. Loading/unloading time: 15 minutes each (optimized process)

4. No delays or breakdowns

5. Trains operate 24 hours a day

6. Perfect coordination and full capacity utilization

**Calculations:**

**1. Time for one round trip:**

Travel time: (100 km / 200 km/h) \* 2 = 1 hour

Loading/unloading time: 0.25 hour \* 4 (load and unload at both ends) = 1 hour

Total round trip time: 1 + 1 = 2 hours

**2. Number of people moved per round trip:**

10 trains \* 1000 people = 10,000 people

**3. Number of round trips needed:**

900,000,000 people / 10,000 people per trip = 90,000 trips

**4. Total time needed:**

90,000 trips \* 2 hours per trip = 180,000 hours

180,000 hours / 24 hours per day = 7,500 days

7,500 days / 365 days per year ≈ 20.55 years

Best-case scenario analysis:

**1. Time frame:** It would take approximately 20.55 years to relocate the entire population.

**2. Efficiency:**

Trains would operate at maximum capacity and optimal speed.

Minimal time wasted in loading/unloading.

No time lost due to breakdowns or delays.

**3. Social impact:**

While still a long time, it's within a single generation's lifespan.

Better potential for keeping communities together during relocation.

**4. Economic impact:**

Shorter overall disruption to economic activities.

Lower cumulative operational costs compared to worst-case scenario.

**5. Logistical advantages:**

Shorter distance allows for more frequent trips and faster overall relocation.

Easier to maintain supply chains for food, water, and other essentials.

**6. Health and safety:**

Reduced time in temporary conditions could lead to better health outcomes.

Less exposure to potential risks associated with long-term temporary housing.

**7. Environmental impact:**

While still significant, the environmental impact would be less than in the worst-case scenario due to shorter operational time.

**8. Infrastructure wear:**

Less cumulative wear on trains and tracks, potentially reducing maintenance needs.

This best-case scenario, while still highlighting the enormous scale of the task, shows a more manageable timeframe. However, it's important to note that even this optimistic scenario would require unprecedented levels of coordination, resource allocation, and sustained effort over two decades.

The stark difference between the worst-case (192 years) and best-case (20.55 years) scenarios underscores the critical impact of factors like distance, speed, and efficiency in large-scale logistics operations.