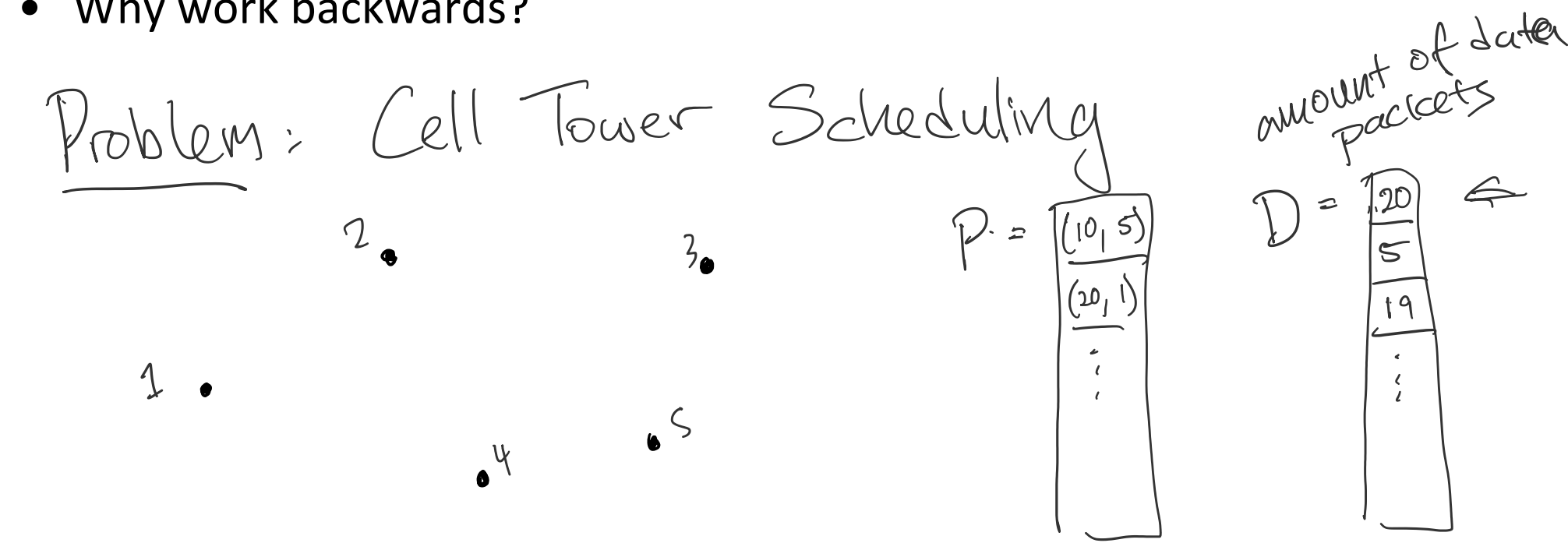


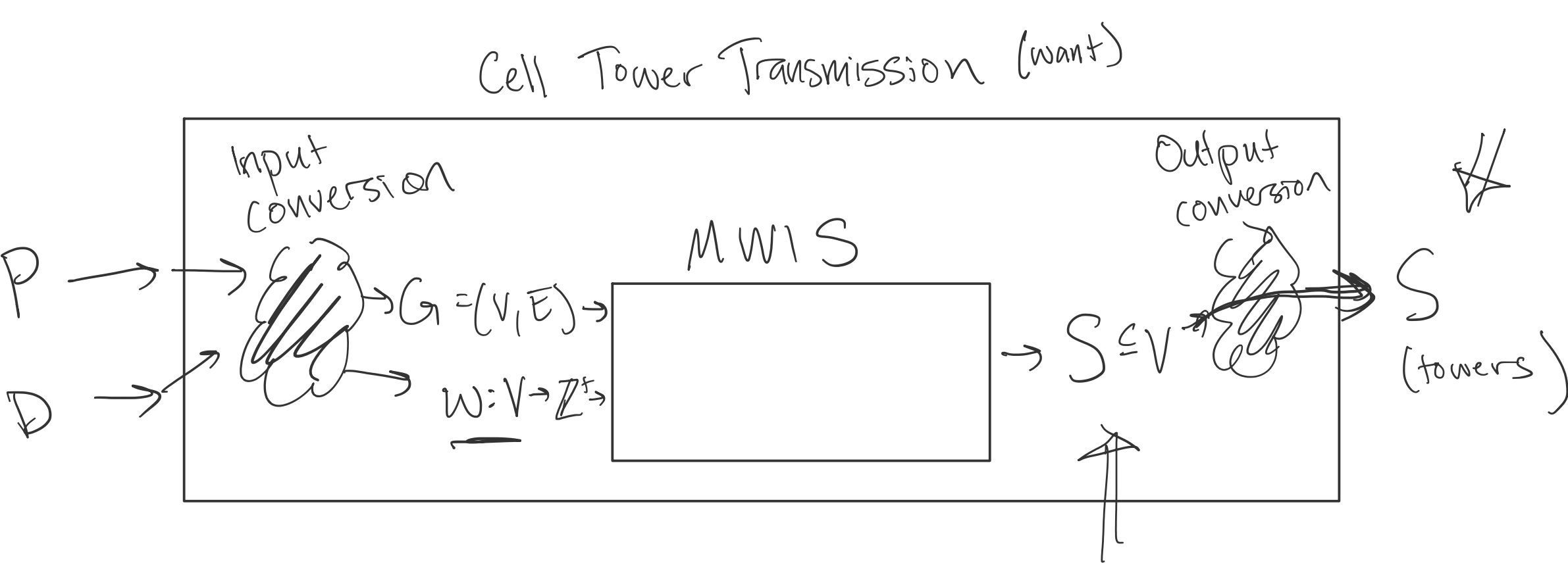
- Goals:
- Design a reduction
 - Describe importance of reductions

Reminders/Questions: Probability/Quicksort Review: <https://www.cs.middlebury.edu/~skimmel/Courses/302S22/>

- Last day with these groups!
- Prog. Ass. No assumption of unique x,y
- Why "DP"
- Why work backwards?



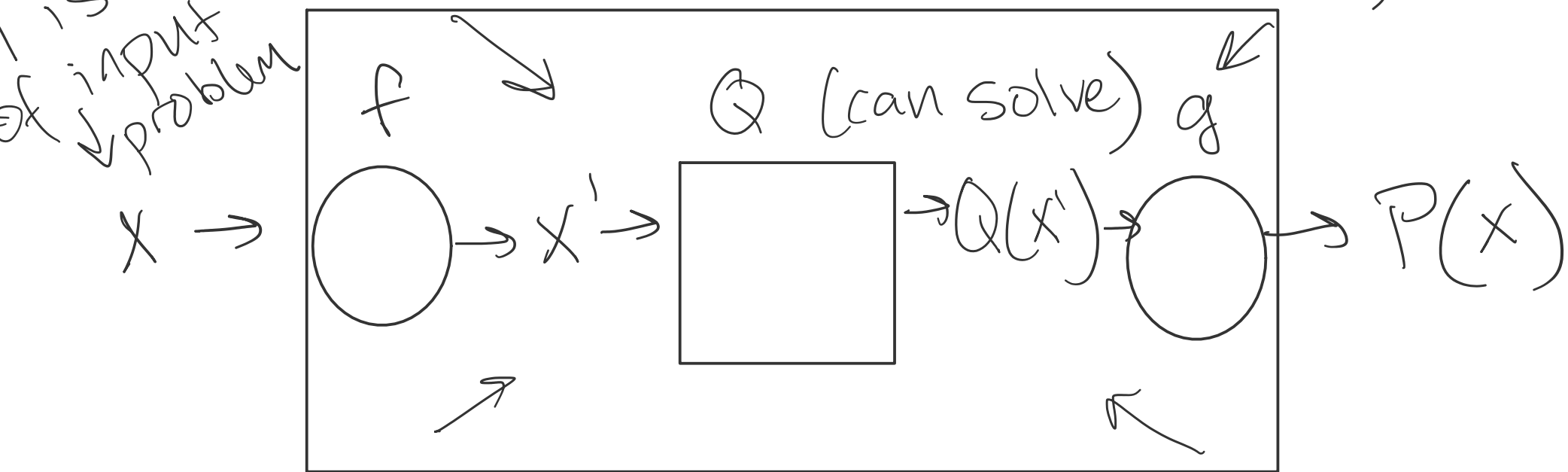
Output: Set of towers to broadcast in the next time step. If two towers w/in 2 miles of each other broadcast → interference.



- Feedback loop to increase prioritization of current prioritized group.
- Behavior could help the company determine how to improve network

1. Ethical concerns? Towers with more packets get priority → Prioritize heavy users (wealthy users), prioritize urban / younger vs non-urban / older
Geographic inequalities (placing towers fairly) → could allow companies to prioritize users
↓
throttle
2. Describe conversion strategies:
- Each tower is a vertex
 - Weight is # data packets
 - Edges b/t two towers/vertices if dist is less than 2 miles
- $P, D \xrightarrow{?} V, E, w$
 $S \xrightarrow{?} S$
(vertices) (towers)
3. What is runtime of each conversion strategy?
(In terms of n, number of towers.)
(Brute force OK)
- For $j \in P$
For $j \neq i \in P$
| Check distance and if less than 2, add edge } $\begin{matrix} \leftarrow O(n) \\ \leftarrow O(n) \\ \leftarrow O(1) \end{matrix} \Bigg\} O(n^2)$
- 1.
- 2.
- 3.

More General Reduction



Runtime : Runtime f + Runtime Q + Runtime g

Usually want: $f, g \leq Q$

If Runtime (f,g) is $O(\text{poly}(n))$ polynomial in n
↓
 $O(n), O(n^2), O(n^3); \dots O(n^d)$ constant ↓

we write:

'P is polynomial time reducible to Q'

↪ $P \leq_p Q$ ~ Q is harder than P ⇐
Q gives us the power to solve P

- Goals:
- Describe importance of reductions
 - Analyze how pivot choice affects QuickSort
- Reminders/Questions:
- Probability/Quicksort Review: <https://www.cs.middlebury.edu/~skimmel/Courses/302S22/>
 - GHC panel Tuesday at 7 on zoom (see e-mail)
 - Reductions compared to 301? Polynomial time, concrete examples, less formal (no languages)

- Why think about reductions?
- Practical: If have alg for Q, use it to solve P
 - Conceptual: Give us a way to compare the difficulty of problems