# CompSci 161
# Winter 2023 Lecture 23:
# Greedy Algorithms

# Interval Coloring

- $n$ groups requested to use a study room
- group $i$ would like to use it from $s_i$ to $f_i$.
- Cannot put overlapping in same room
- Cannot reject a group.
- Minimize number of distinct rooms assigned
- Why is your algorithm correct?

# Interval Coloring Solution

**Algorithm:** When a group arrives, give lowest numbered room currently free.

- How many rooms will this use?

- Could any solution use fewer? Why or why not?

# Approximate TSP

Traveling Salesperson Problem

Let's look at TSP with:

- A *complete* graph : all pairs of vertices, $\exists$ edge.
- Triangle inequality; $c_{uv} + c_{vw} \geq c_{uw}$.

Goals:

- Fast algorithm (polynomial time)
- Provide some correctness guarantee.
  In this case, I will show:

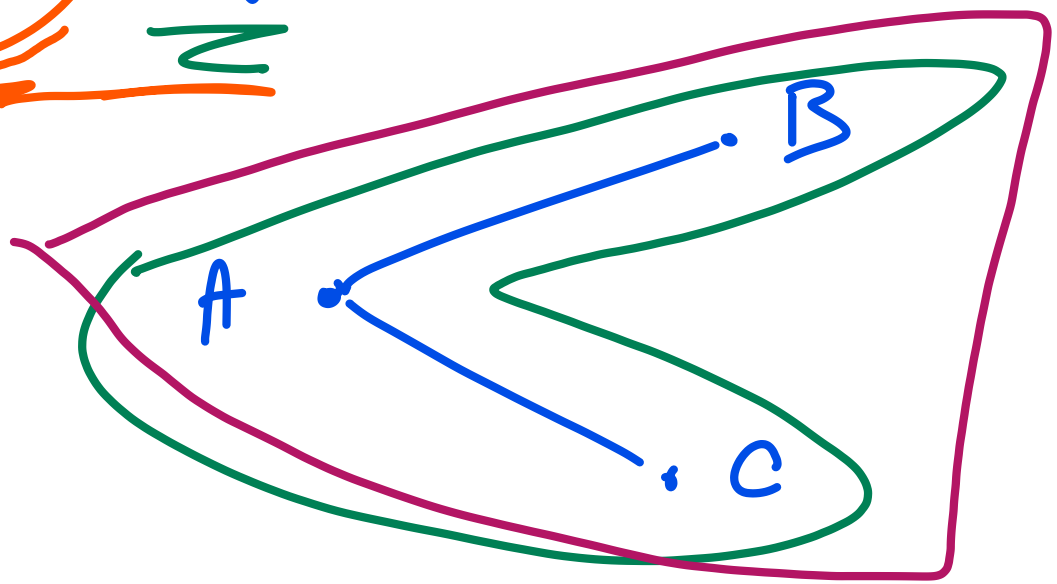
$$\frac{\text{our cost}}{\text{optimal cost}} \leq 2$$

# Approximate Metric TSP

1. Find MST $T$ of $G$
2. Do depth-first walk $W$ of $T$
3. Output vertices in order seen on $W$

$2\,\text{cost}(T) \le 2\,OPT$

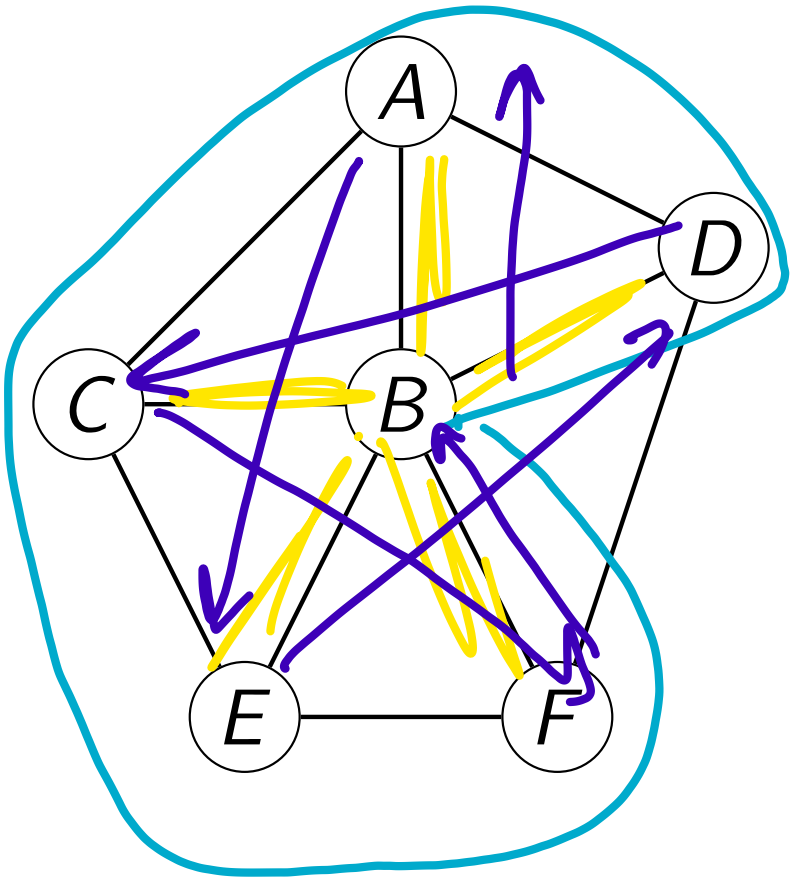
$J \le W = 2 \cdot \text{cost}(T) \le 2 \cdot OPT$




A B A C

A B – C

# How accurate is that bound?




- Shown edges: cost 1
- Others : cost 2
- Optimal journey?
- What is MST?

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Depth First Journey

1 + 2 + 2 + 2 + 2 + 1 = 10

# How to Measure

- Given a fast-but-wrong algorithm for TSP
- How do you measure its accuracy?
- Proofs are fine
- Can you do something experimental?