

# Lecture - 13

## Sampling Based Planners

PRM  $\rightarrow$  last lecture

(multi-query)

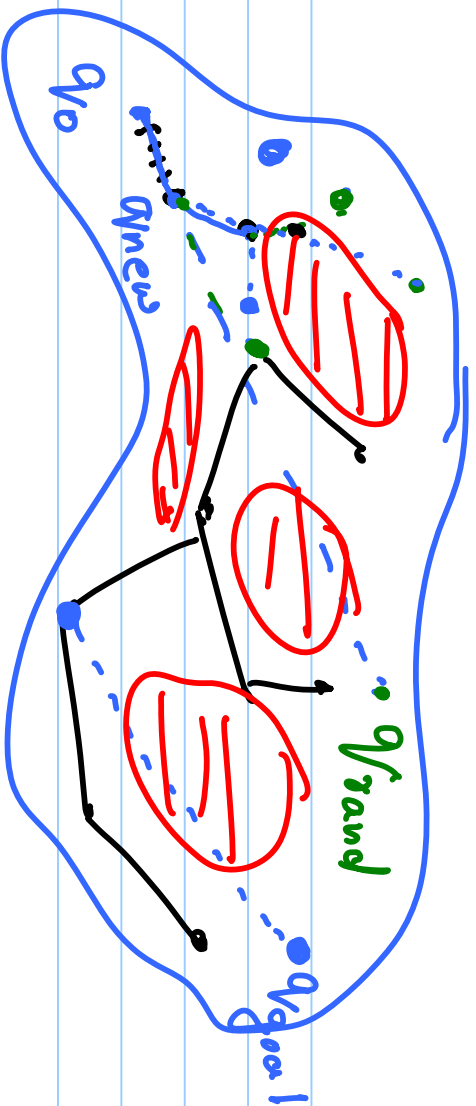
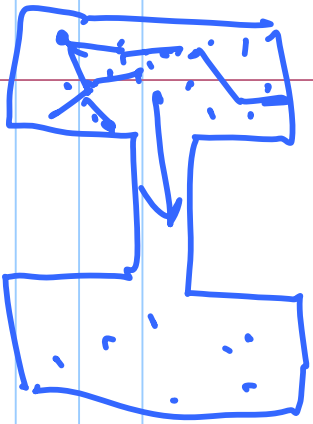
planner

RRT  $\rightarrow$  Randomized Reachable Trees

(single query)

planner

Given start config,  $q_0$  find a path to goal.



expands a tree rooted at  $q_0$ .

**Build**

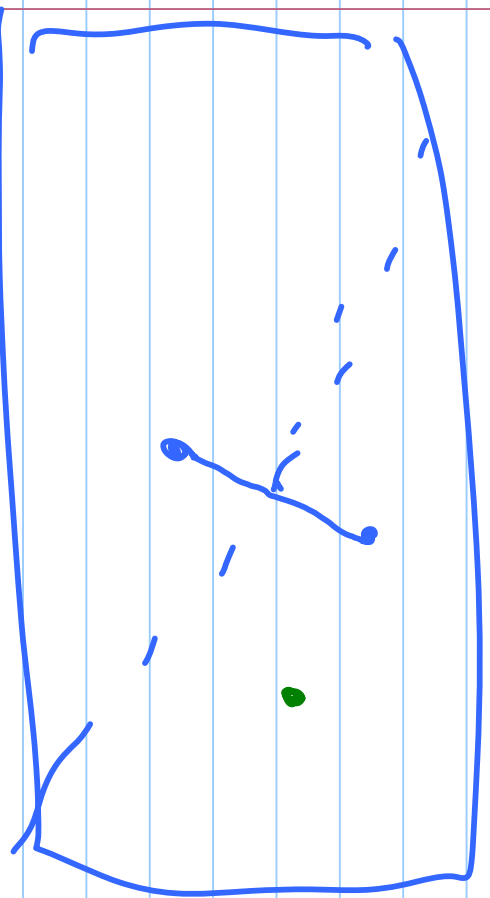
Throws a random node in c-space.  $q_{rand}$

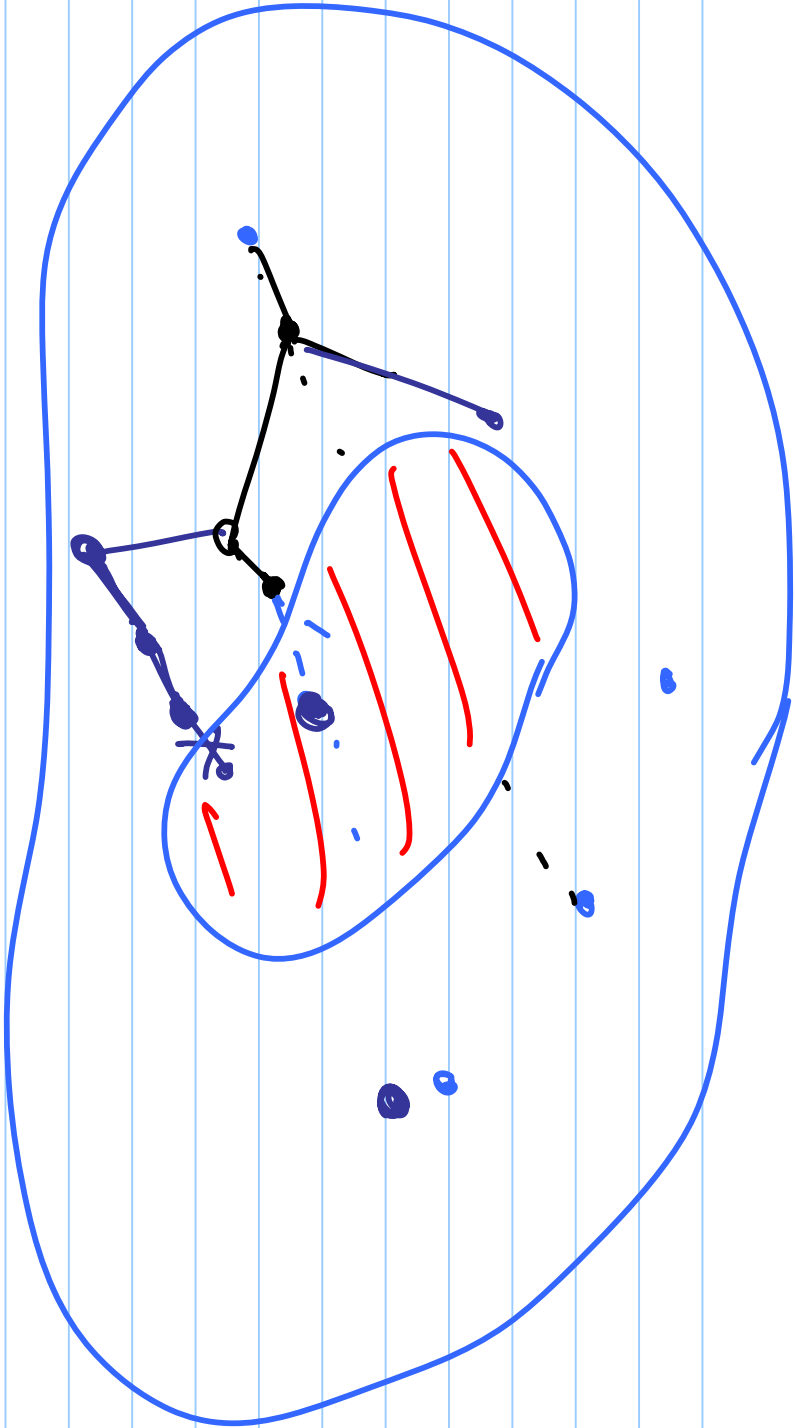
determine the closest node in

the tree to  $q_{rand}$ . call this  $q_{near}$

Extend  $q_{near}$  towards  $q_{rand}$  in  
a "step size"  $\delta$  steps

Repeat } if the new node along step size is free,  
|| call it q<sub>new</sub> and add to Tree.  
|| also add edge (q<sub>near</sub>, q<sub>new</sub>) to the tree  
~~else repeat~~  
end





Yasong ⑤ Collision Detection: Between two polyhedras

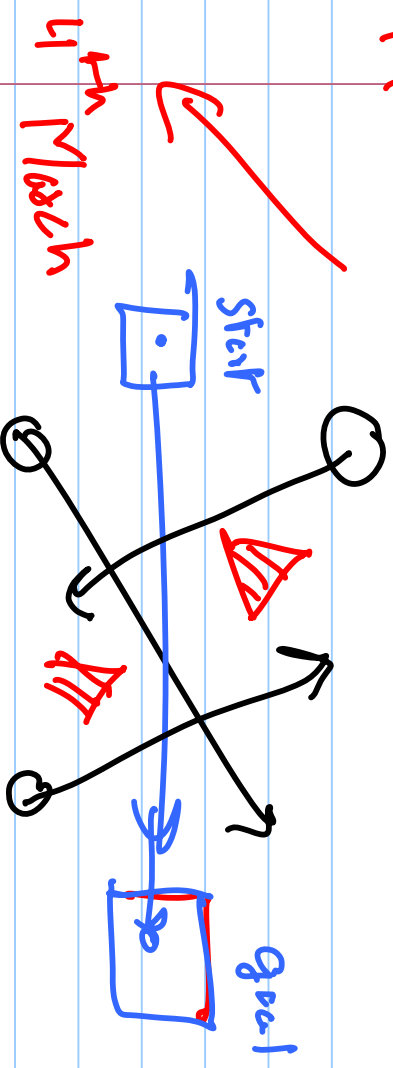
Extensions to Basic Path Planning

Key issue: understand the basis

① how fast representation of environment

② represents ④ Time-varying environment / moving obstacles / multiple moving robots

③ Round → known → str line with const. velocity



Key issue / insight: Goal pose X time

9th March  
Vijay

②

Sensor-based planning

with uncertainty

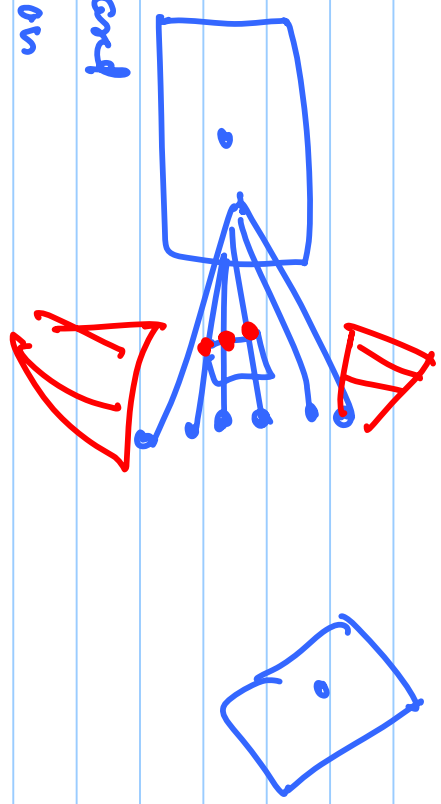
Static case

Key Issues: ?

1) use a Model-based path planner to plan within known

2) where to look?

3) integrate env. info from different "Scans"



③

Jalal

11th March

Dynamic / non-holonomic Constraints

|| differential constraints ||

Key issue: ~~to~~ plan in "state-space"

$$\dot{v} \times \dot{q}$$

"sampling based planners" the

most useful.

ANSWER  
विचार

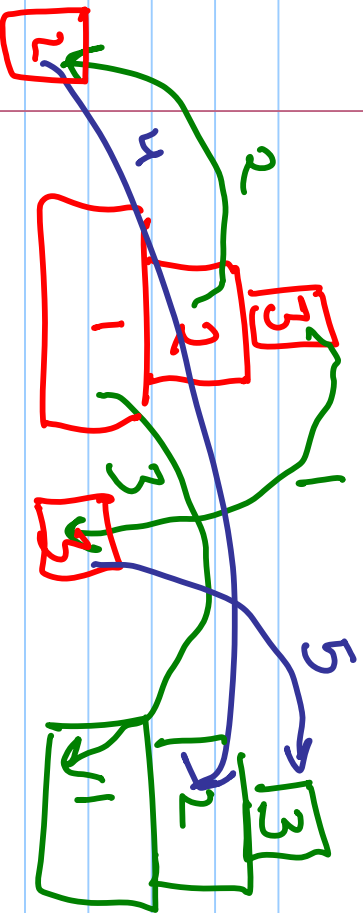
④ Manipulation planning / movable objects  
"pick & place task"

KEY ISSUE:

- ① Robot's pose changes in a ~~the~~ well-defined way when it is holding ~~the~~ a movable object
- ② Coupled to grasping



### ③ Combi na Forics Game into play



Each class → presentation by  
the assigned  
3-4 papers student

2-3 → theory/algorithm 50-55 → 90 min  
1 → implementation 25-40

→ interactive

→ power point + whiteboard / tablet

→ present at appropriate level of detail  
to communicate central ideas.

→ expect all students to have  
read the papers, not just  
the presentation

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Merhs for participation  
for audience  
presenta to consult Kama

in advance, if needed.  
feel free.