

ECE6133 Final Project

Implementation of the **A-Tree** Algorithm

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Contents

1

Problems in A-tree

2

Modified A-tree

3

Demo

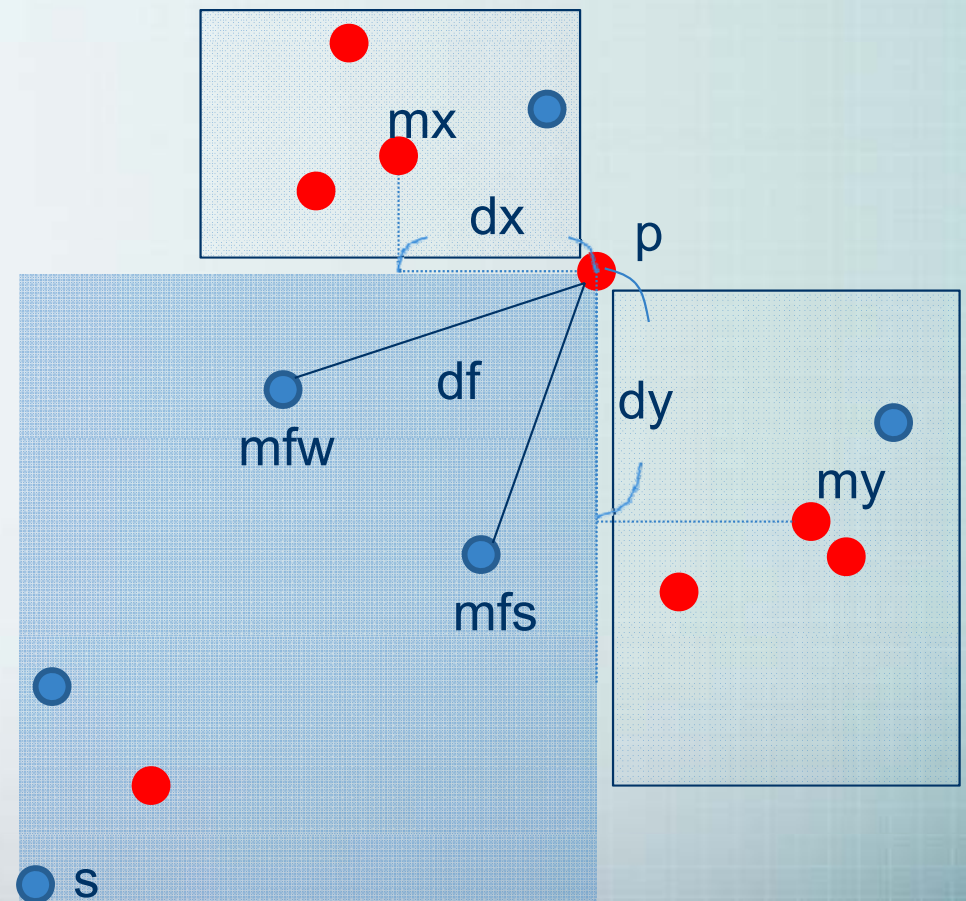
4

Result

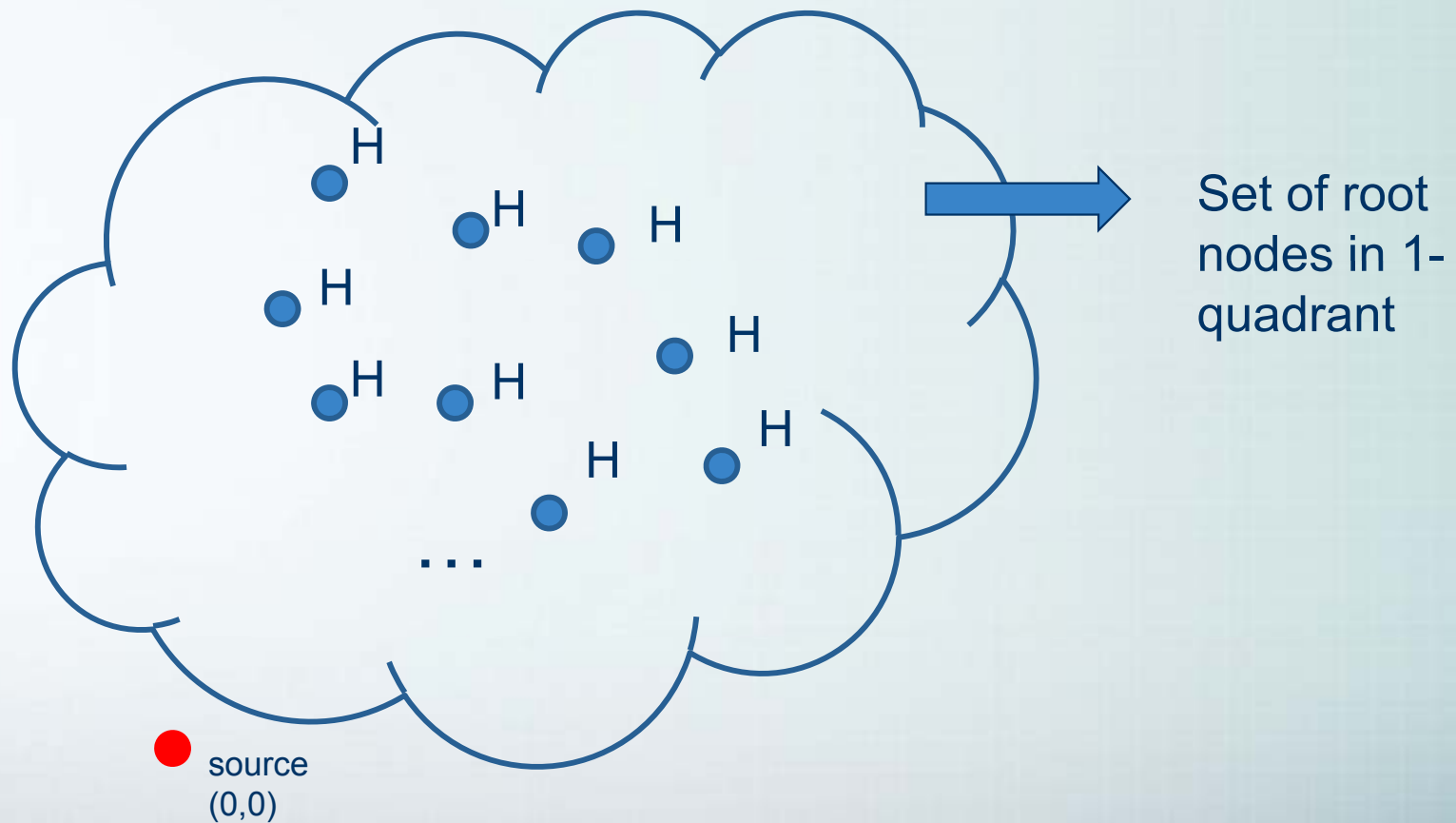
1. Problems in A-tree

❖ 1. Do we need to perform H-move?

- S1: $dx \geq df$, $dy \geq df$
- S2: $dx \geq df$, $dy < df$
- S3: $dx < df$, $dy \geq df$
- H : $dx < df$, $dy < df$

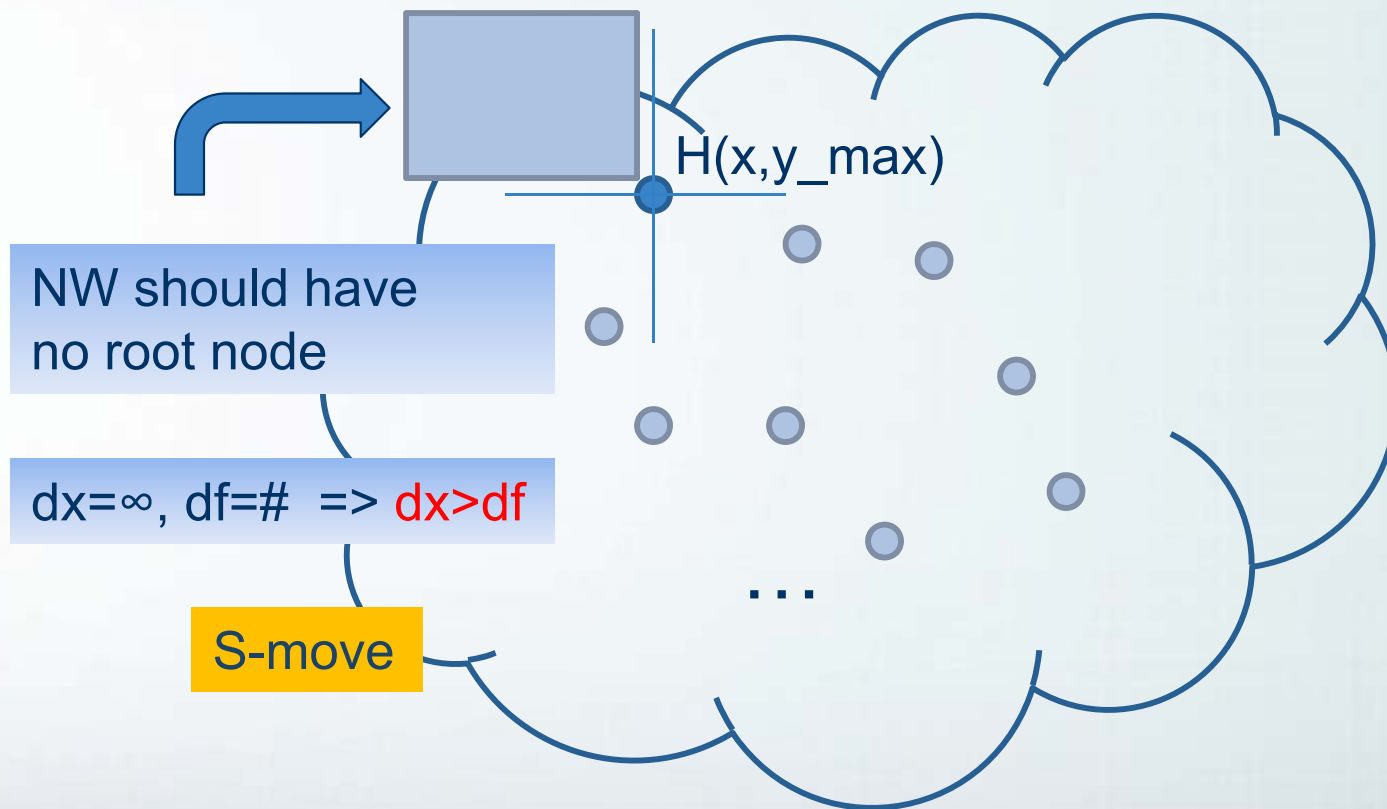


1. Problems in A-tree



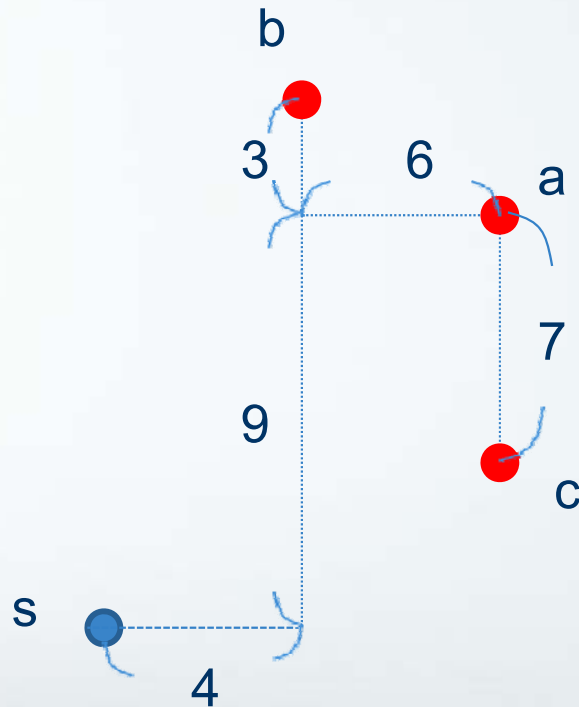
1. Problems in A-tree

H-move $\Rightarrow dx < df, dy < df$



1. Problems in A-tree

❖ 2. Node Isolation



ROOT={a,b,c}

	dx	dy	df	mfw	mfs	move
a	6	∞	7	c	c	S3

S3: $dx < df$, $dy \geq df$

S3 move:

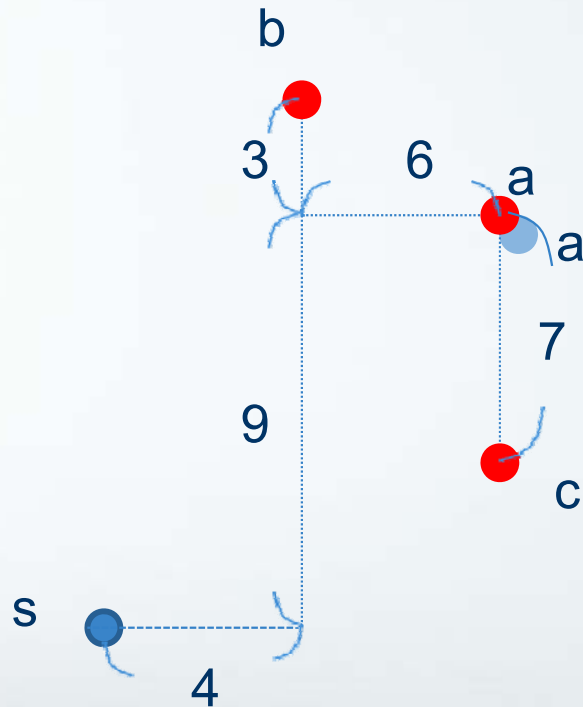
$$f(a) = \min\{ \text{dist}_x(\text{mfw}(a, F_k), a), dx(p, F_k) \}$$

$$= \min\{ \text{dist}_x(c, a), dx(p, F_k) \}$$

$$= \min\{ 0, 6 \} = 0$$

1. Problems in A-tree

❖ 2. Node Isolation



ROOT={a',b,c}

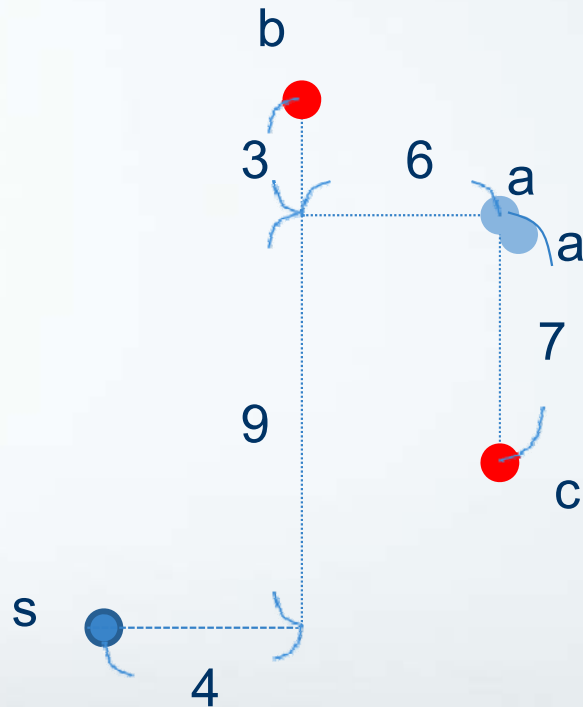
	dx	dy	df	mfw	mfs	move
a'	6	∞	0	a	a	S1

S1: $dx \geq df, dy \geq df$



1. Problems in A-tree

❖ 2. Node Isolation

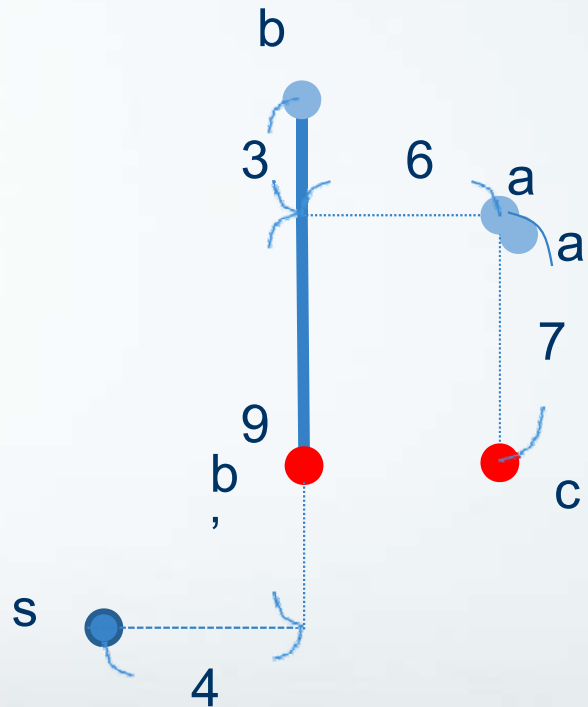


ROOT={b,c}

	dx	dy	df	mfw	mfs	move
b	∞	10	16	s	s	S2

Problems in A-tree

❖ 2. Node Isolation

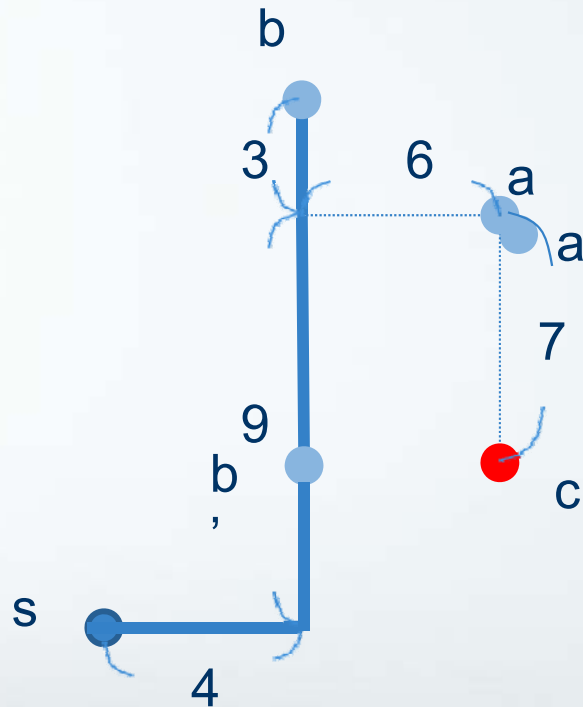


ROOT={b',c}

	dx	dy	df	mfw	mfs	move
b'	∞	∞	6	s	s	S1

1. Problems in A-tree

❖ 2. Node Isolation

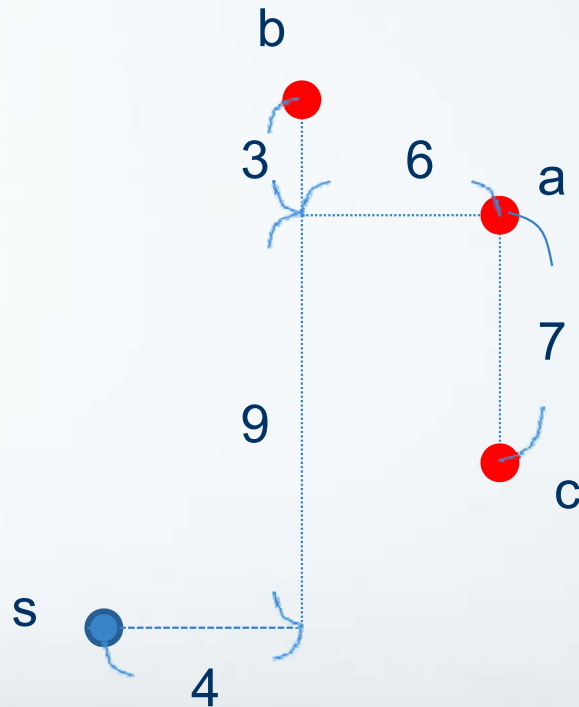


ROOT={c}

	dx	dy	df	mfw	mfs	move
c	∞	∞	6	b'	b'	S1

2.Modified A-tree

❖ What's wrong?



ROOT={a,b,c}

	dx	dy	df	mfw	mfs	move
a	6	∞	7	c	c	S3

S3 move: a → a' — a

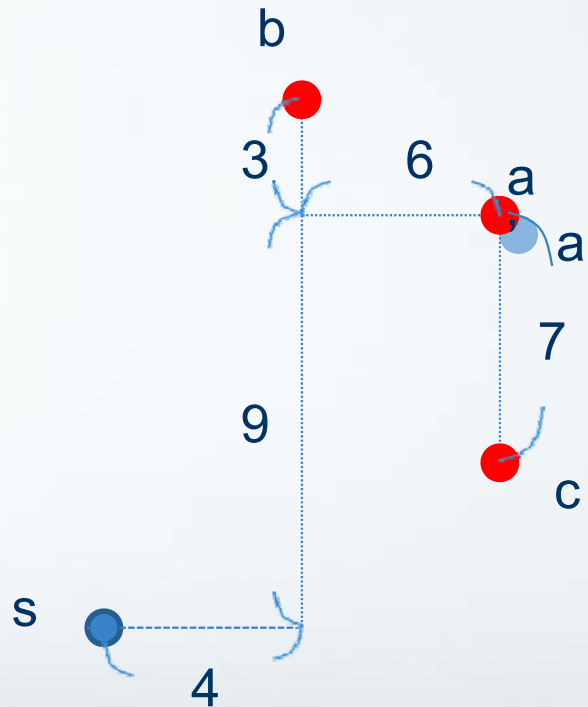
$$\min\{ \text{dist}_x(\text{mfw}(a, F_k), a), dx(p, F_k) \}$$

$$\min\{ \text{dist}_x(c, a), dx(p, F_k) \}$$

$$\min\{ 0, 6 \} = 0$$

2.Modified A-tree

❖ Overlapped Steiner-point



ROOT={a',b,c}

	dx	dy	df	mfw	mfs	move
a'	6	∞	0	a	a	S1



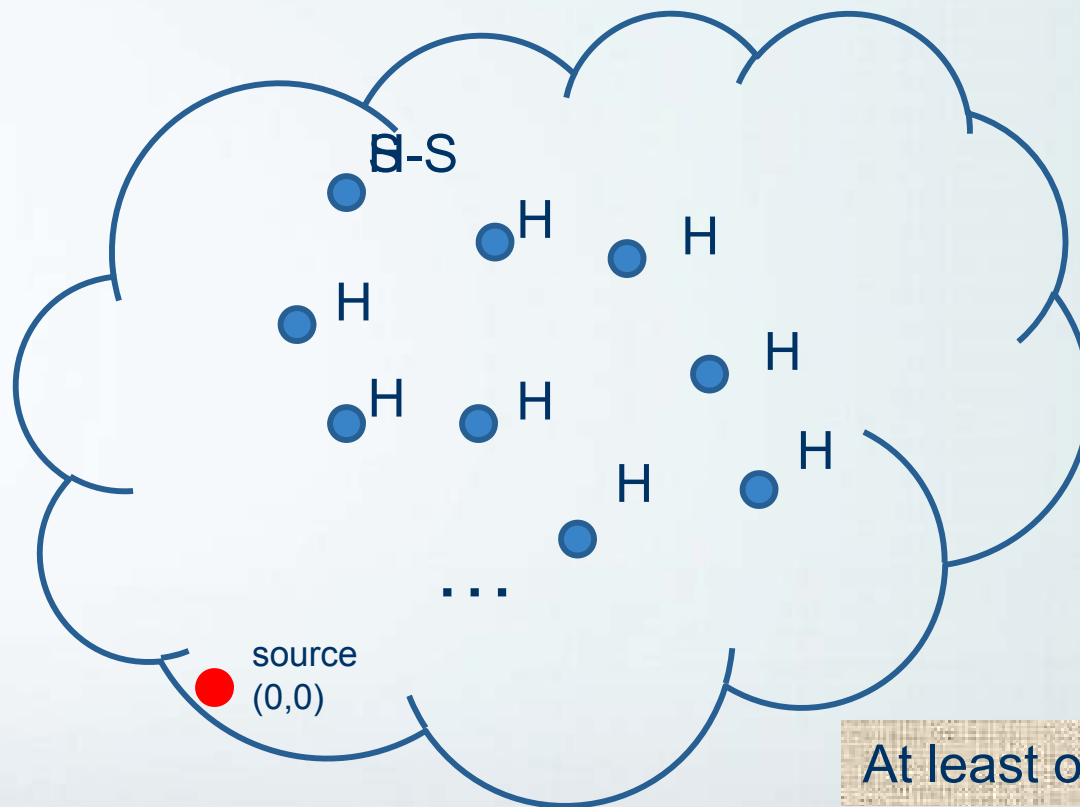
2. Modified A-tree

❖ Modify S2 & S3

- When $\text{dist}_y(\text{mfs}(a, F_k), a) = 0$ in S2
=> "H-S2"
- When $\text{dist}_x(\text{mfw}(a, F_k), a) = 0$ in S3
=> "H-S3"

2. Modified A-tree

❖ Simple proof



2. Modified A-tree

❖ Modify S2 & S3

- When $\text{dist}_y(\text{mfs}(a, F_k), a) = 0$ in S2
=> "H-S2"
=> Choose d_y instead of dist_y
- When $\text{dist}_x(\text{mfw}(a, F_k), a) = 0$ in S3
=> "H-S3"
=> Choose d_x instead of dist_x

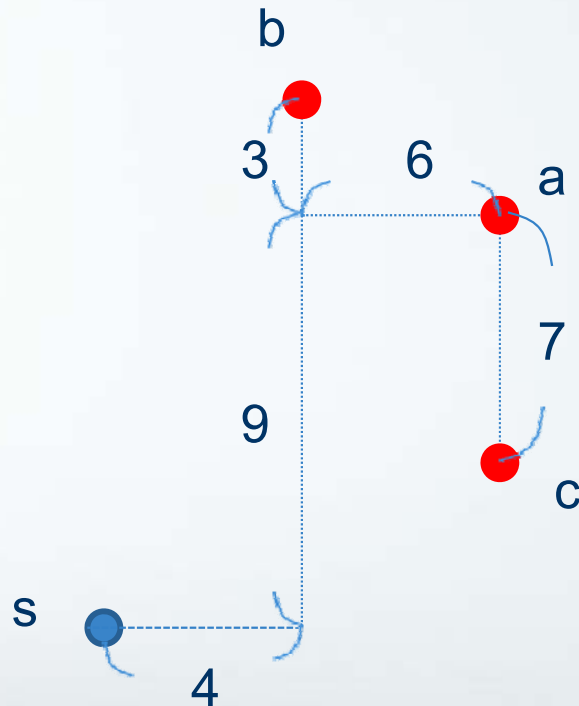
2.Modified A-tree

❖ Move Priority



2. Modified A-tree

❖ 1. No Isolation



ROOT={a,b,c}

	dx	dy	df	mfw	mfs	move
a	6	∞	7	c	c	S3

➔ H-S3

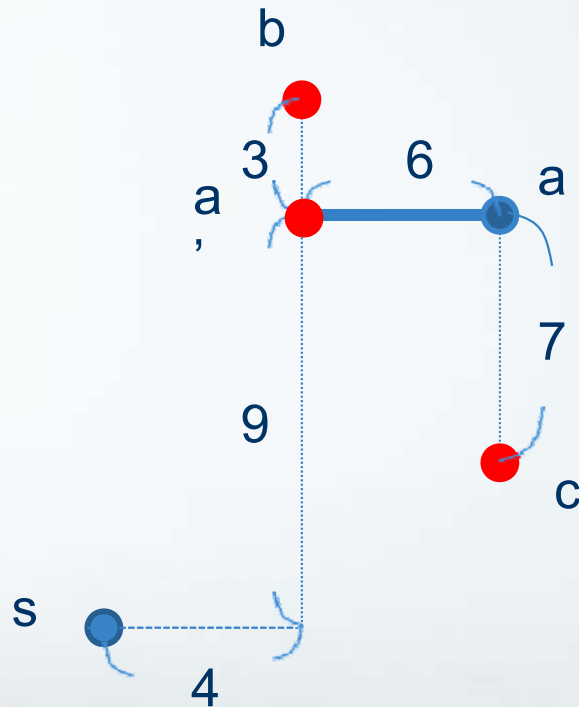
$$f(a) = \min\{ \text{dist}_x(\text{mfw}(a, F_k), a), dx(p, F_k) \}$$

$$= \min\{ \text{dist}_x(c, a), dx(p, F_k) \}$$

$$= \min\{ 0, 6 \} = 0 \Rightarrow 6$$

Modified A-tree

❖ 1. No Isolation



ROOT={a,b,c}

	dx	dy	df	mfw	mfs	move
a	6	∞	7	c	c	S3

→ H-S3

$$\min\{ \text{dist}_x(\text{mfw}(a, F_k), a), dx(p, F_k) \}$$

$$\min\{ \text{dist}_x(c, a), dx(p, F_k) \}$$

$$\min\{ 0, 6 \} = 0 \Rightarrow 6$$

Modified A-tree

❖ 2. Reduce Computation

- Accept the first S-move and break

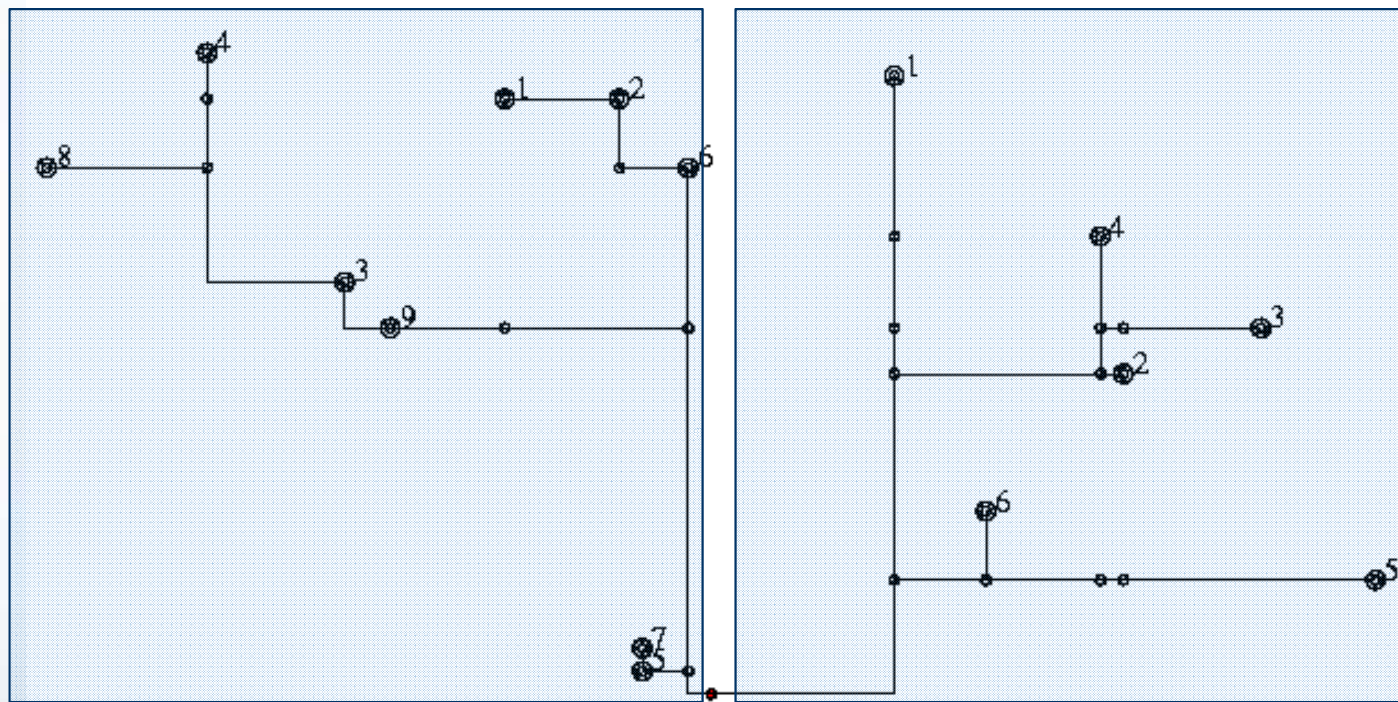
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cnt= 1 head->next= 1
p    mx  dx  my  dy  mfw mfs  df  move
1   -1  999  8   3   2   2   5   H-S2   (9,26)
2   -1  999  8   3  16  16   4   H-S2   (4,26)
3    1   7   -1  999  9   9   4   S1     (16,18)
4   -1  999  8   5   1   1  15   S2     (22,28)
5    6   2   -1  999 19  19   3   S3     (3,1)
6   -1  999  3   5  20  20   1   S1     (1,23)
7    6   2   -1  999  5   5   1   S1     (3,2)
8    4   7   -1  999  3   3  18   S3     (29,23)
9    1   5   -1  999 12  12  14   S3     (14,16)
0-1-2-3-4-5-6-7-8-9-
```

2. Modified A-tree

- ❖ 3. No 1-Quadrant Constraint
 - So far, Dual-Quadrant ver.
 - Original A-tree on each quadrant
VS
Alternative...

2.Modified A-tree

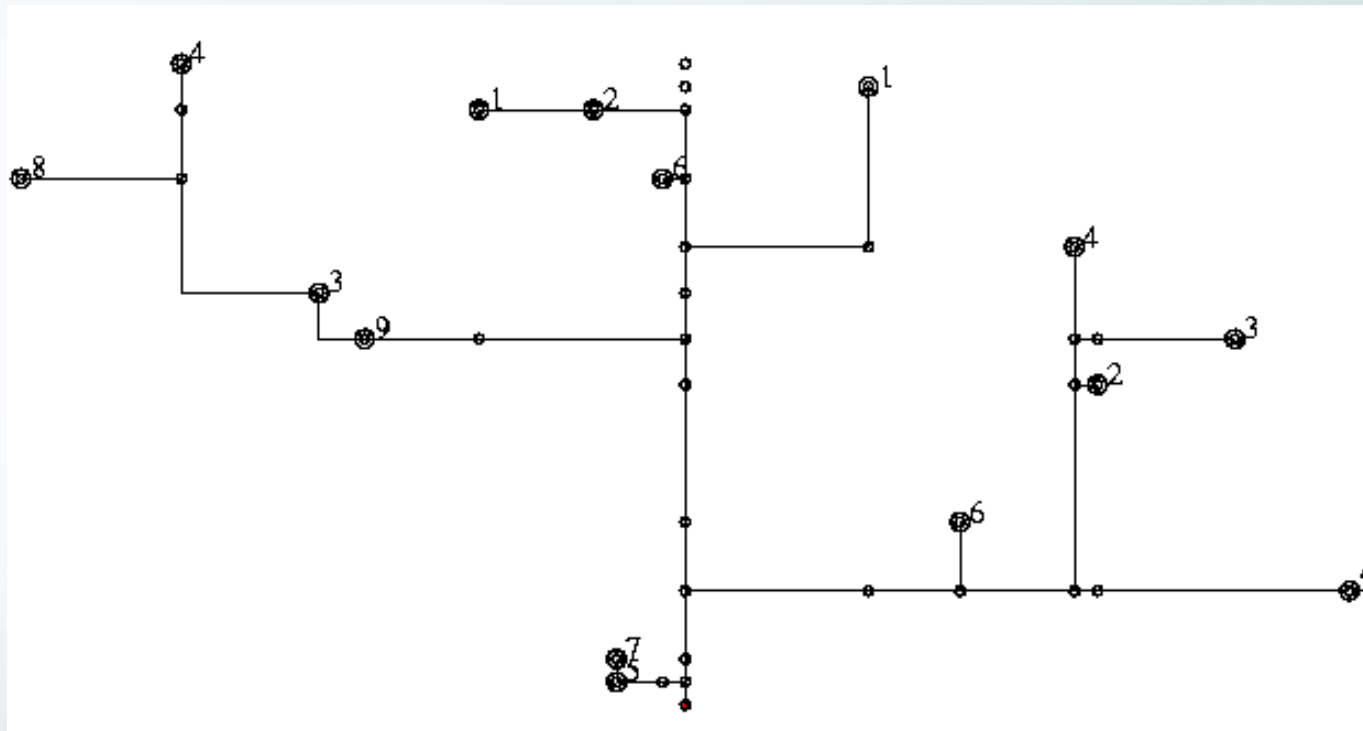
❖ A-tree on each quadrant



Wire Length = 159

2. Modified A-tree

❖ Virtual node on the pole



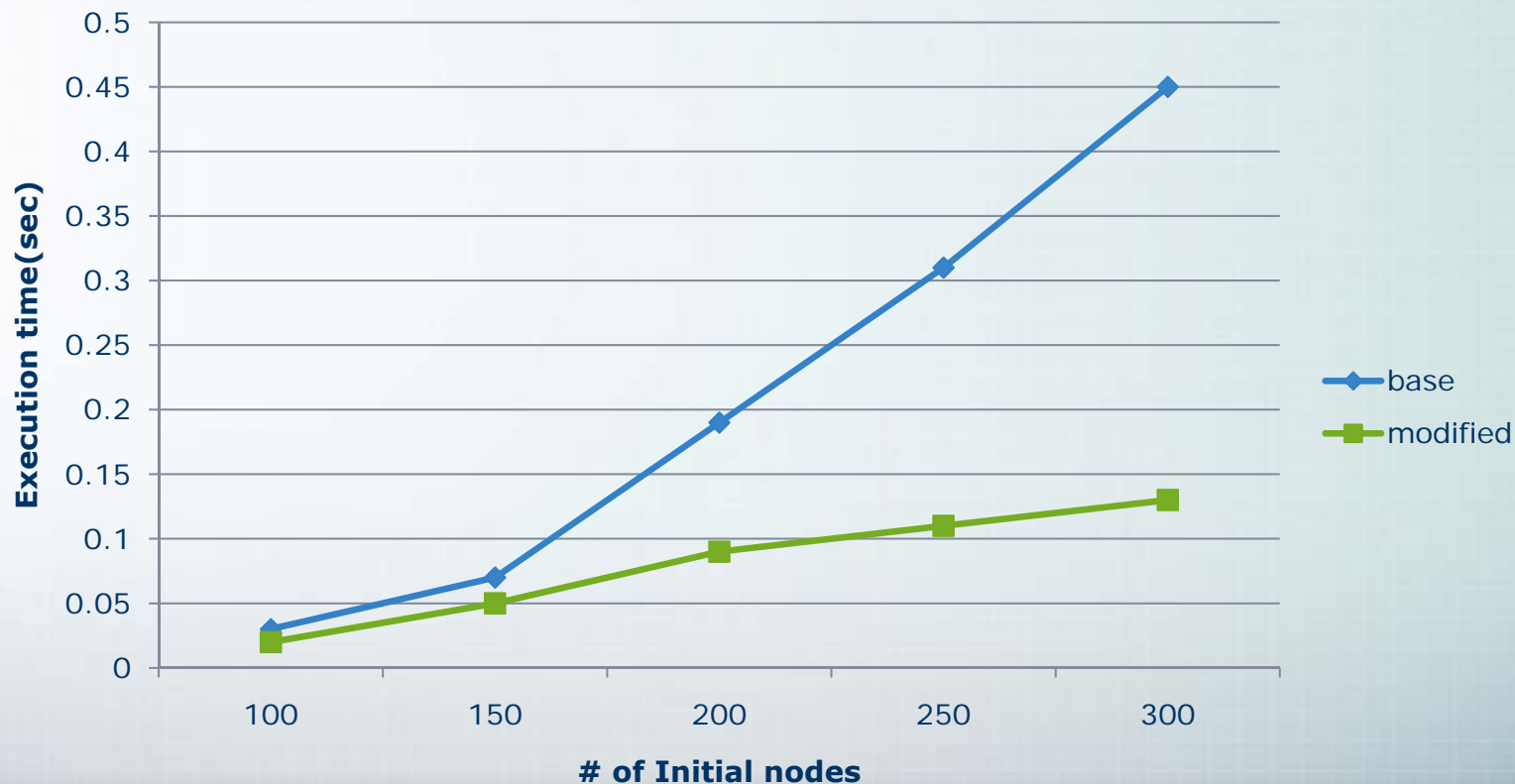
Wire Length = 151

3.Demo

4.Result

❖ Run time

- Base: compute entire root node
- Modified: accept 1st S-move



4.Result

❖ Wire Length

- Base: perform A-tree on each quad.
- Modified: use vertual nodes

