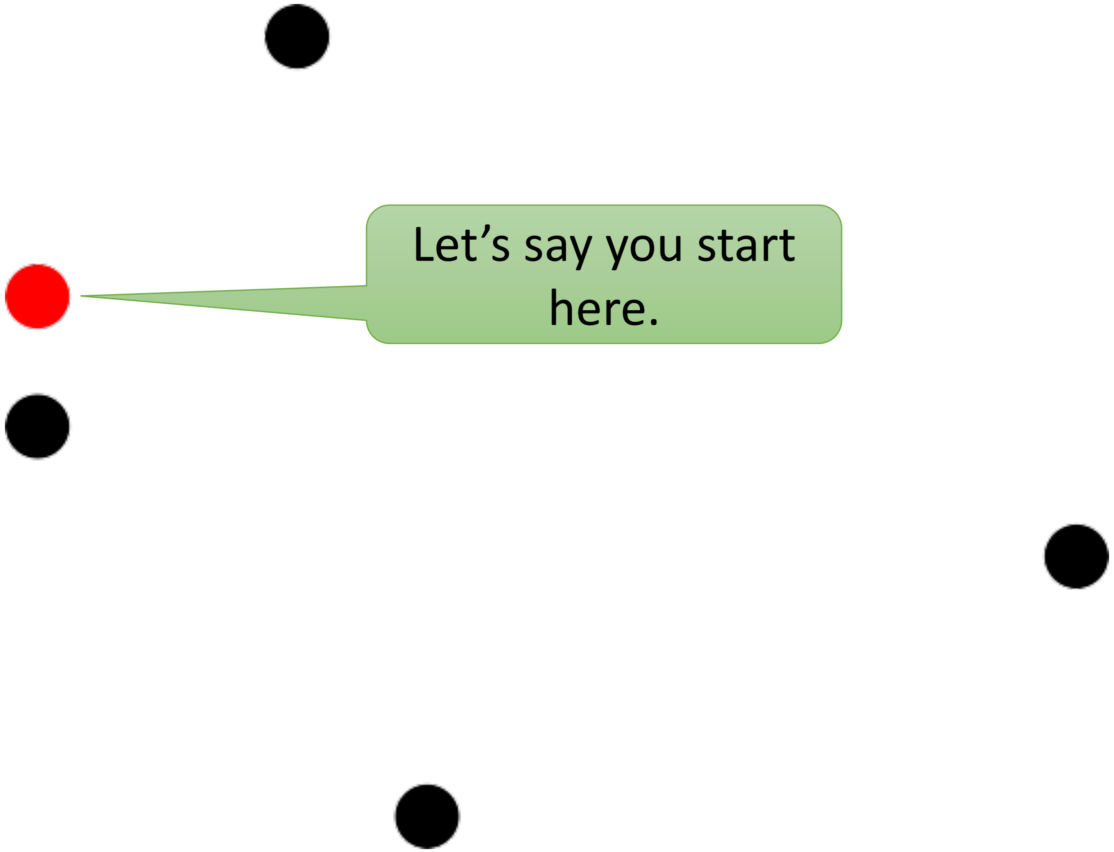
Competitive Programming

Greedy Algorithms

Greedy Choices

- Often, locally greedy choices don't yield globally optimal solutions.
  - TSP for example



Let's say you start here.

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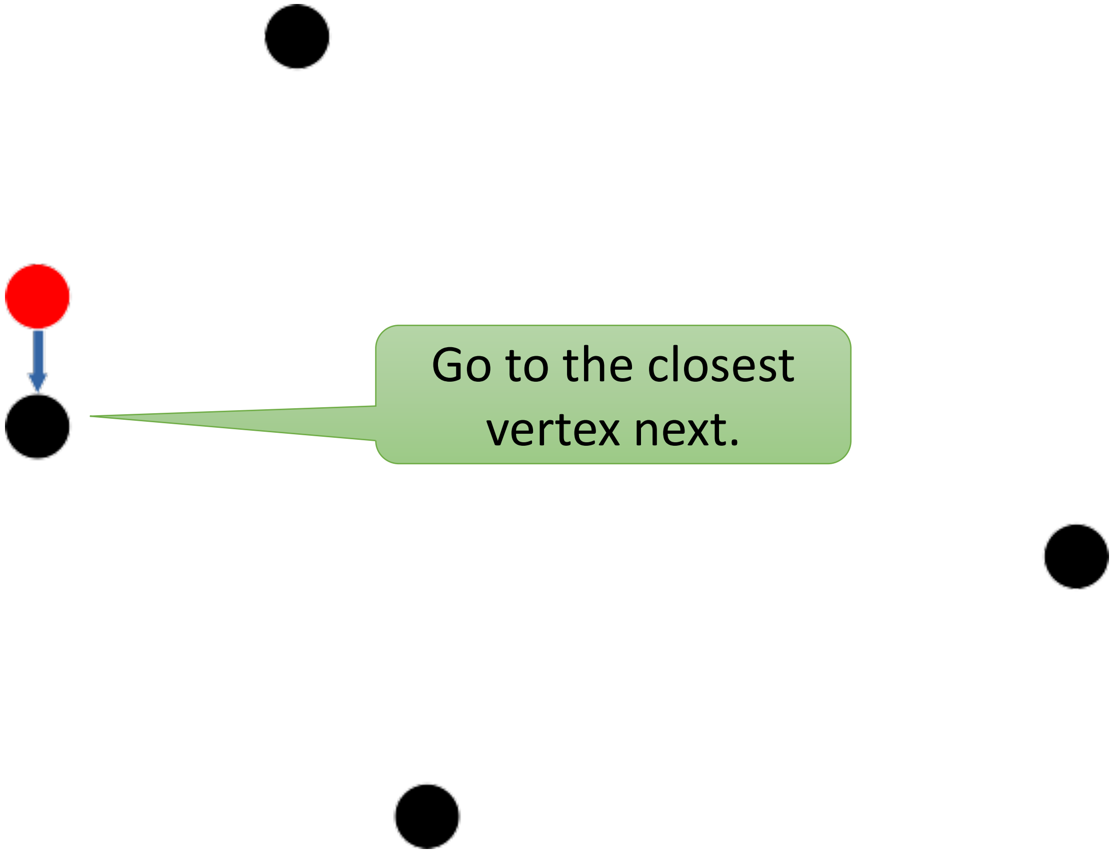

Go to the closest vertex next.

Greedy Choices

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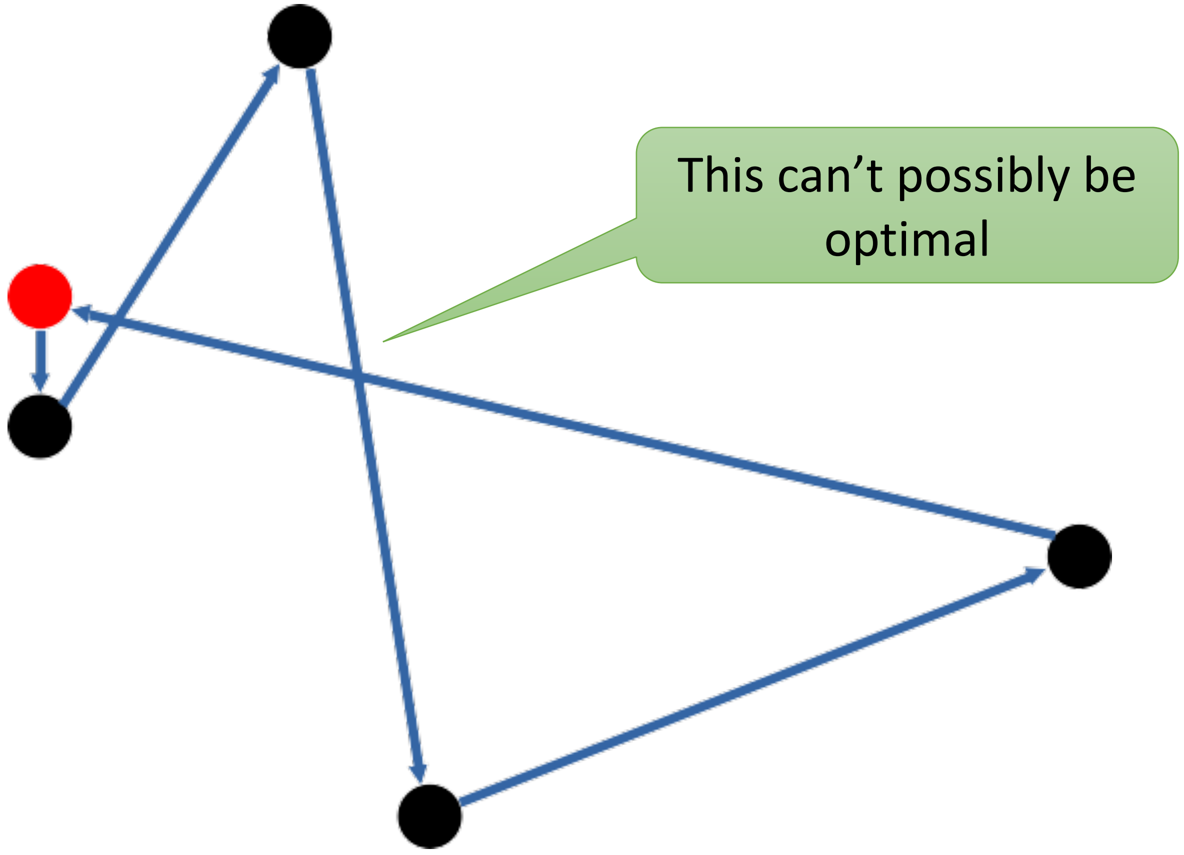
    - Any other NP Complete problem



This can’t possibly be optimal

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  - Any other NP Complete problem
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  - This is a little uncommon
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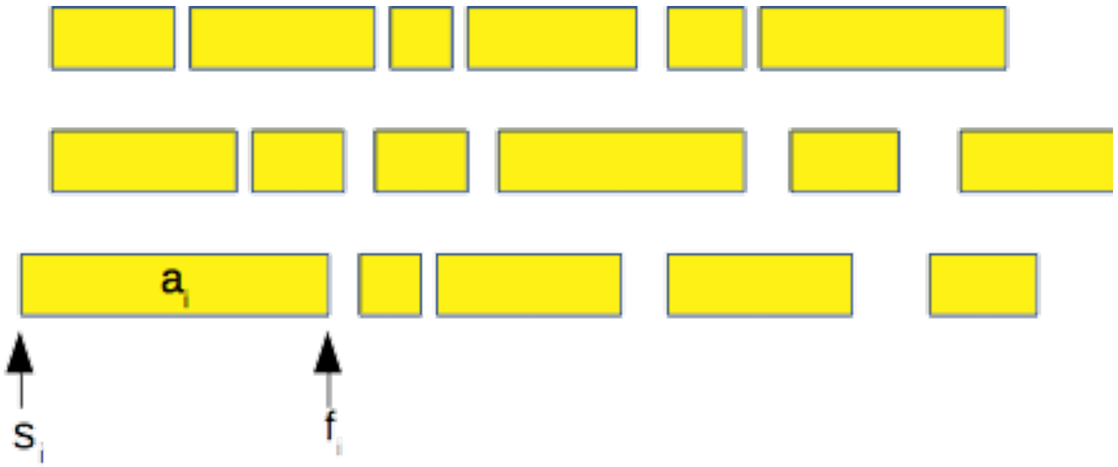
  - That argument usually goes like:
    If you had an optimal solution …
    and it didn’t have the greed choice I’m making here …
    I would be able to improve your solution (or do just as well)

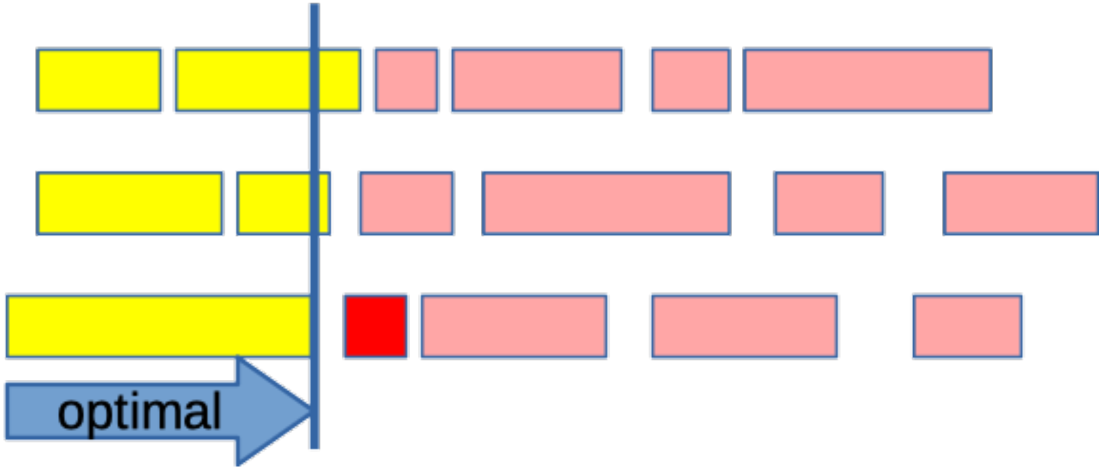
Activity Scheduling

- Given a set of n activities.
- Each with a starting time, s_1 .. s_n
- And a finishing time, f_1 .. f_n
- Want to choose as many activities as possible to participate in



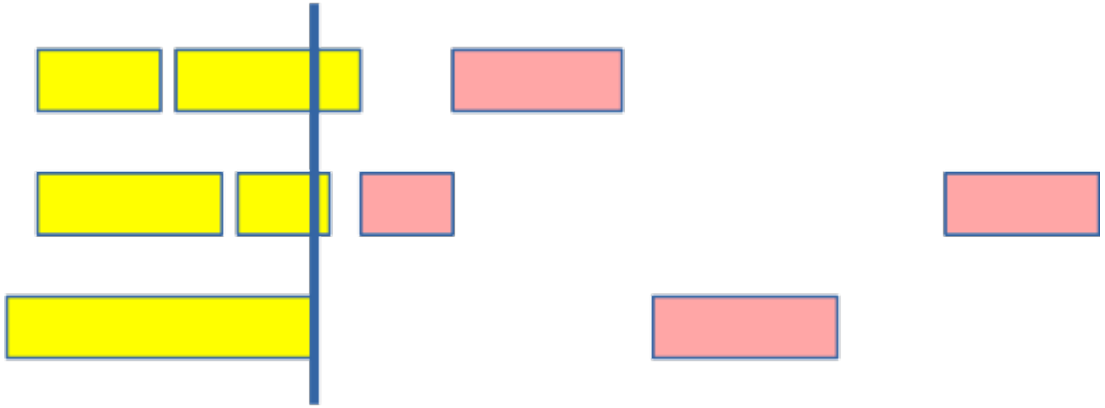
Activity Scheduling

- You can always make a greedy choice
  the next available event that finishes earliest.



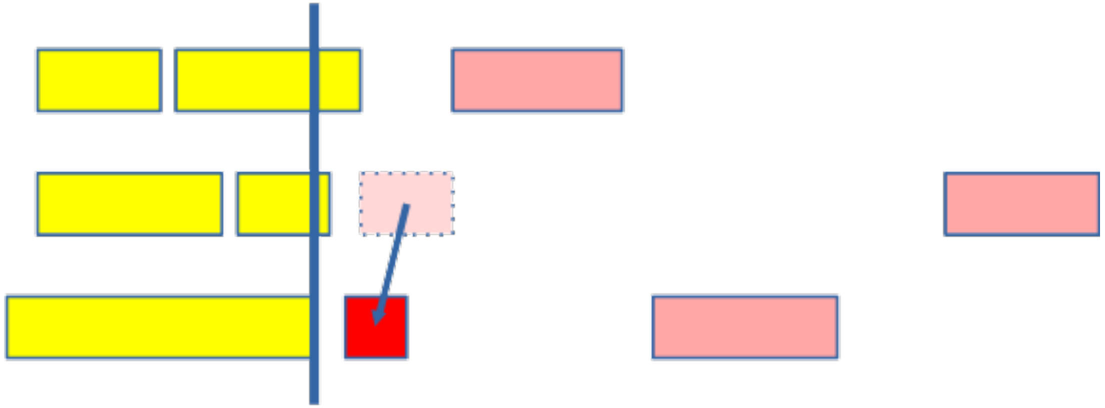
Activity Scheduling

- If there’s some optimal solution that doesn’t use that event.



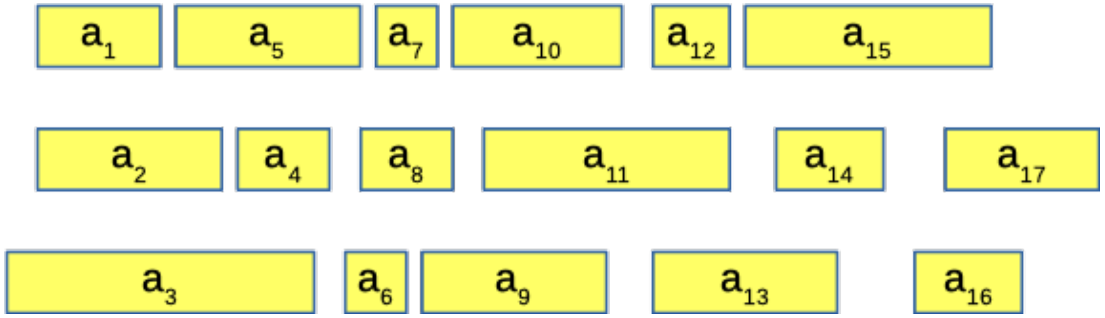
Activity Scheduling

- You can do at least as well by exchanging the next event for the next event for the greedy-choice event.



Activity Scheduling

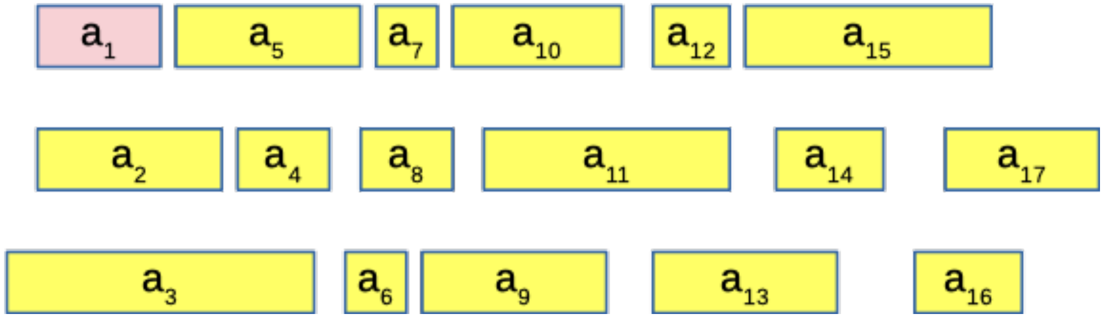
- To make this easy, we can first sort by finishing time.



Activity Scheduling

Sort by finishing time

Take the first-finishing event

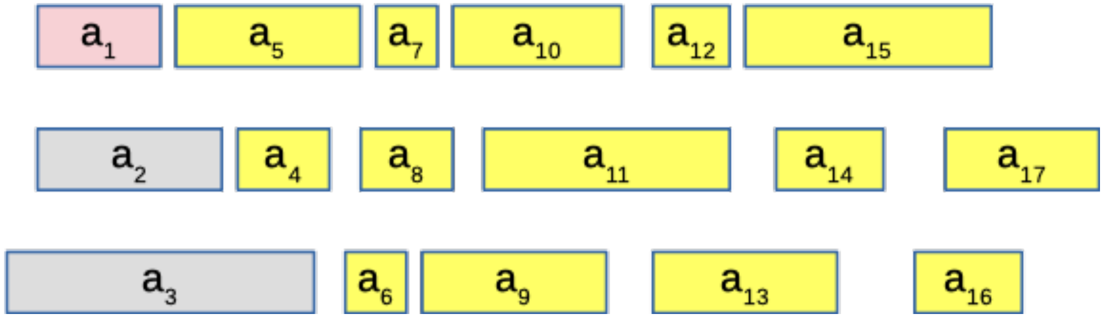


Activity Scheduling

Take the first-finishing event

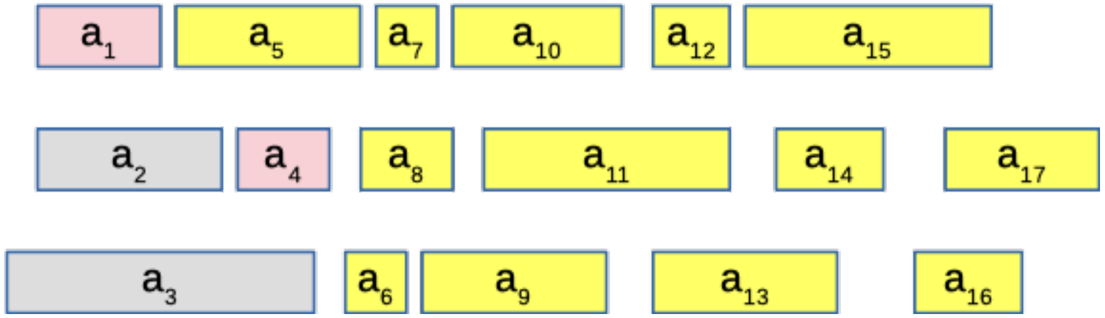
Repeat until no more events

- Discard events that start too early to use



Activity Scheduling

- Take the first-finishing event
- Repeat until no more events
  - Discard events that start too early to use
  - Take the next event



Activity Scheduling

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Repeat until no more events

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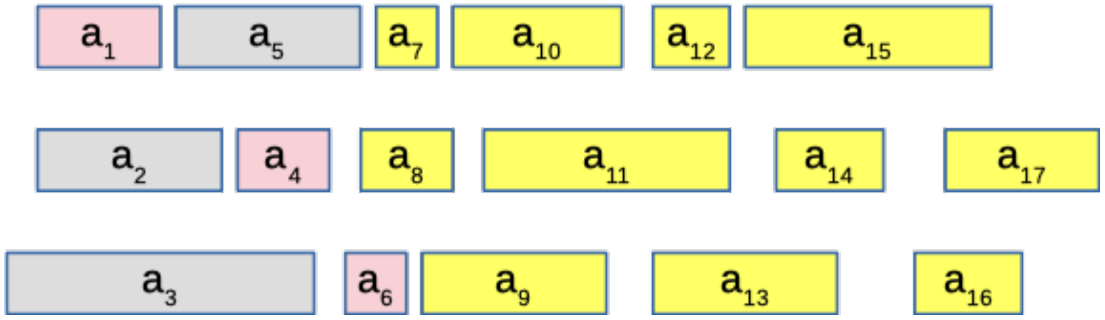

Activity Scheduling

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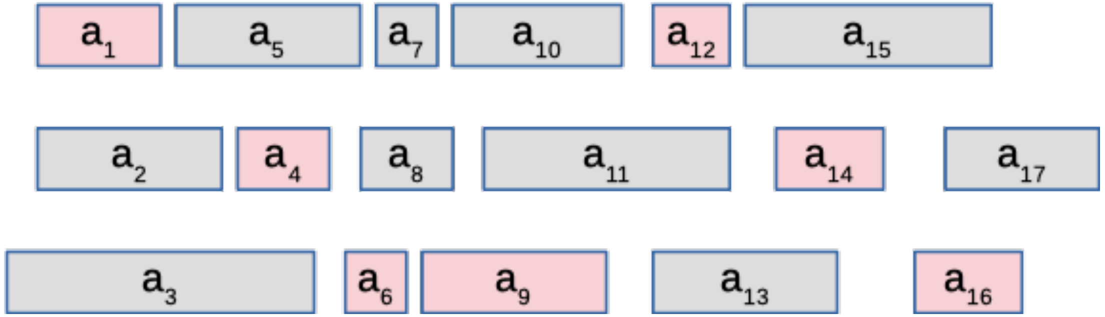
a_1
a_5
a_7
a_{10}
a_{12}
a_{15}
a_2
a_4
a_8
a_{11}
a_{14}
a_{17}
a_3
a_6
a_9
a_{13}
a_{16}