Writing Research Papers and Theses in Computer Science and Engineering

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Outline

Research in Computer Science and Engineering

Steps to follow:

- Study and explore your area of interest.

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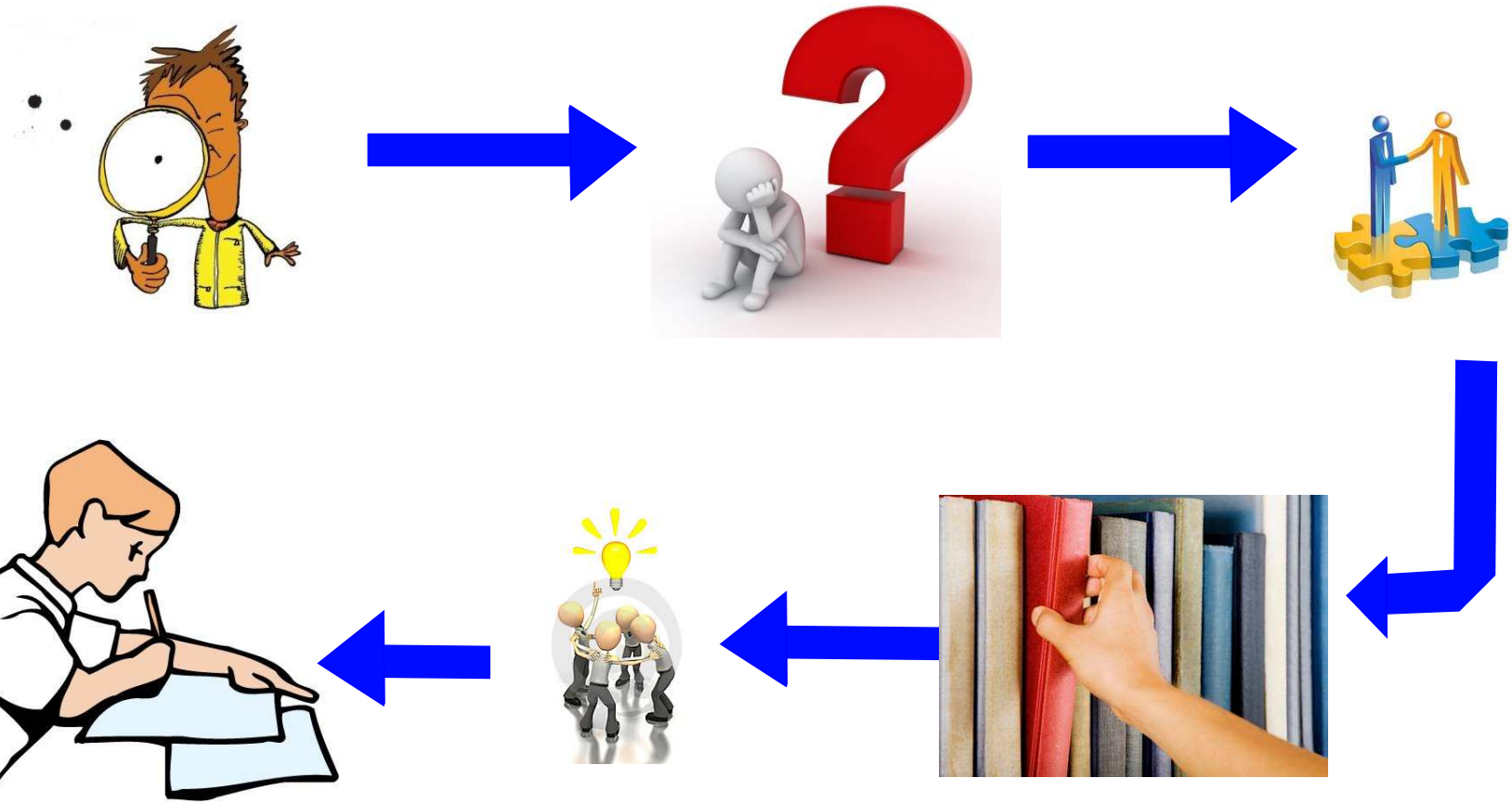
- Read related research papers published in good journals and conferences and present those papers in the group, by rotation.
- Sit frequently for brainstorming on the problem and try to find non-trivial results.
- Perform experiments and simulations if necessary.
- Find good results around the problem and write papers.



Outline

Four Phases

Four phases in dealing with a research problem (G. Polya, 1945)

- Understand the problem.
- Devising a Plan: Analyze how unknown is related to data available and make a plan.
- Carrying out the plan.
- Looking Back: Look back at the complete solution to review and discuss.

Understanding the Problem

Verbal statement of the problem must be understood.

- What are you asked to find or show?
- Can you restate the problem in your own words?
- Can you think of a picture or a diagram that might help you understand the problem?
- Is there enough information to enable you to find a solution?
- Do you understand all the words used in stating the problem?
- Do you need to ask a question to get the answer?

Devise a plan

We will solve current problem using some previously known knowledge. Liturature study is necessary.

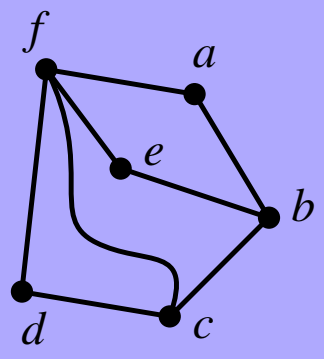
- Do you know a related problem?
- Look at the unknown. Try to think of a familiar problem having the same or similar unknown.
- If it looks very difficult to solve the problem, try to solve first some easier related problem. In that case could you restate the problem?

Carrying out the plan

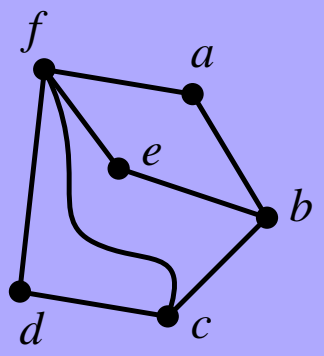
- Develop intuitive idea to solve the problem.
- Examine step wise and prove correctness.
- Verify your results.

Looking Back

- Can you derive the result differently?
- Can you see it at a glance?
- Did you use all the data?
- Can you use the result or the method for some other problem?



A planar graph G



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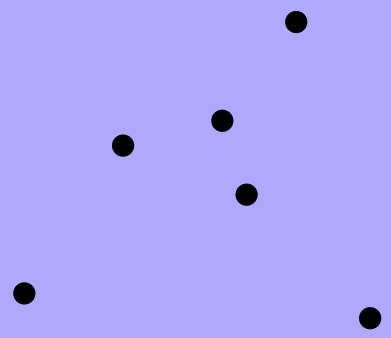
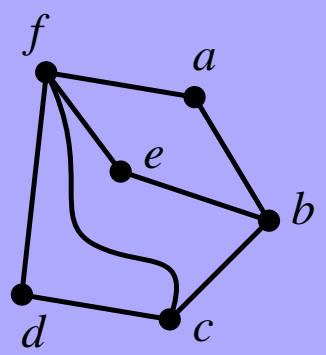


A point set S



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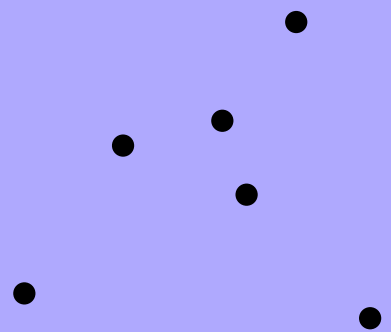

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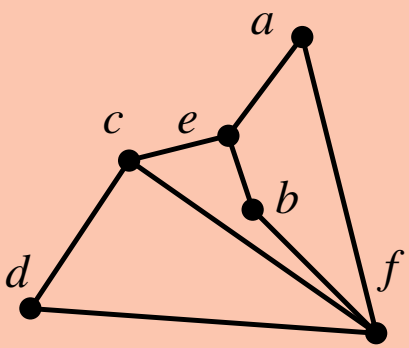
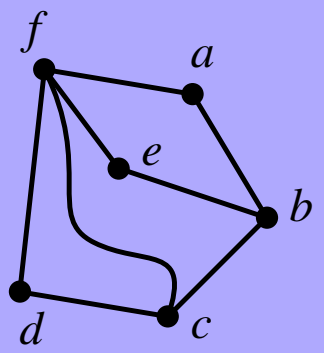


G on S

Pointset embedding

Input: a graph G and a pointset S
Output: find a drawing of G on S such that each vertex of G lies on a point of S and each edges is drawn as a straight-line segment.



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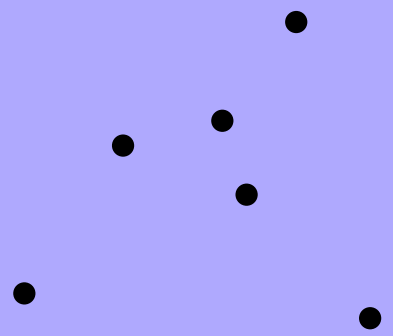

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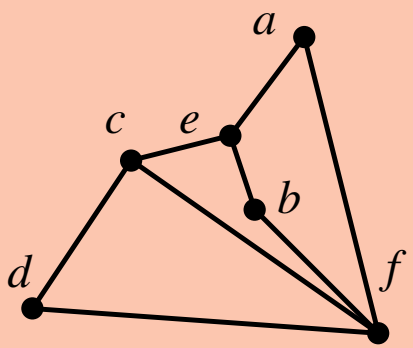

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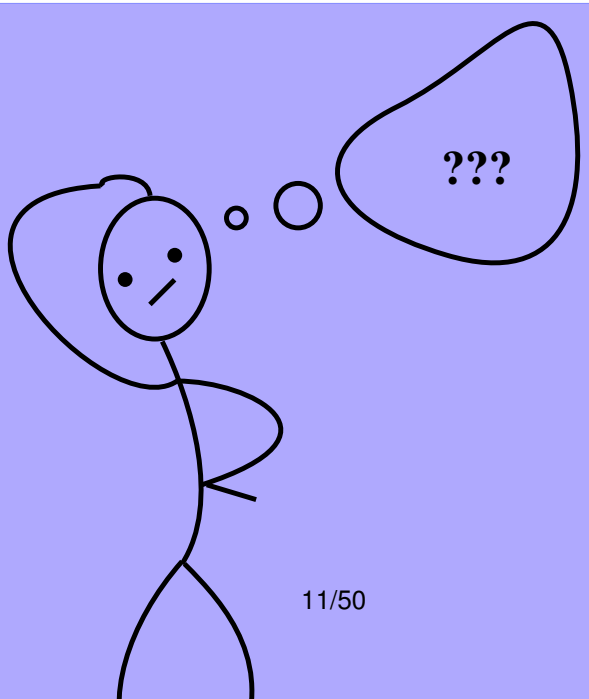

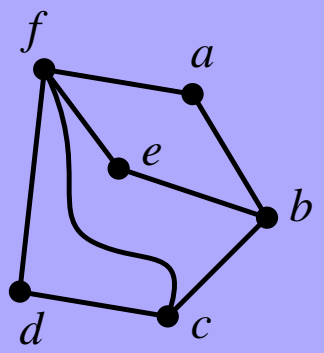

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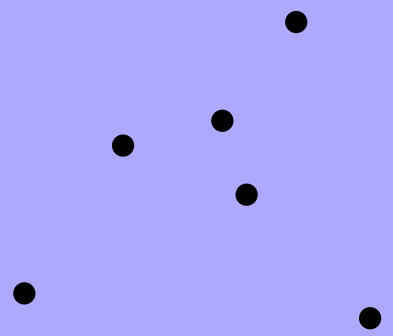

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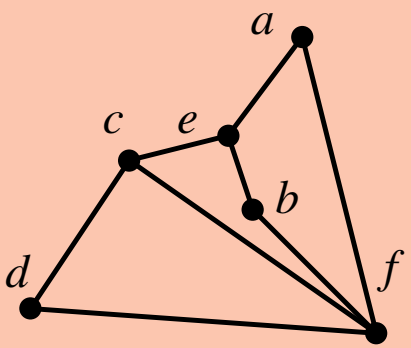

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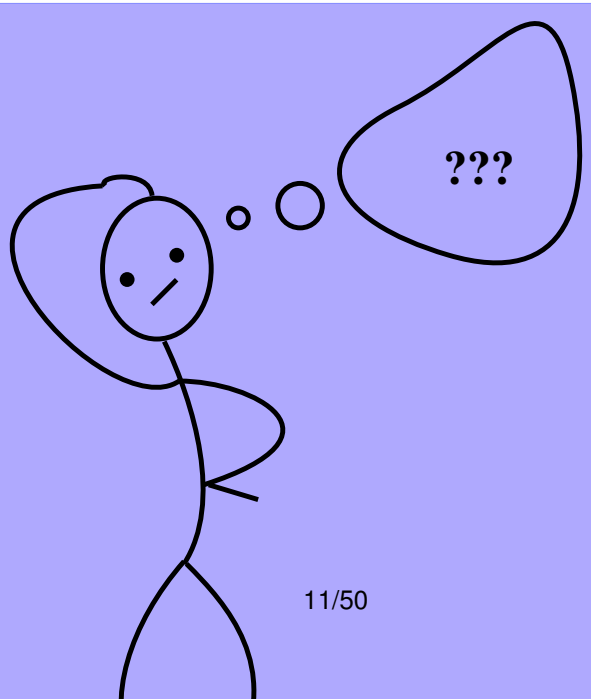

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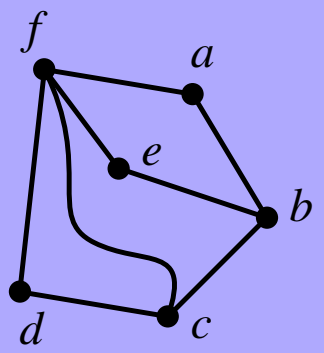

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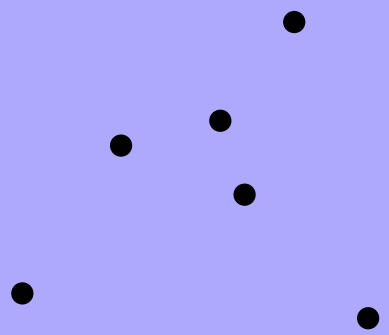

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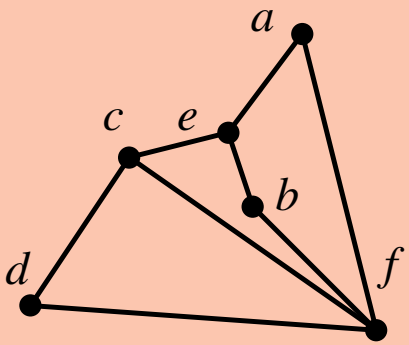

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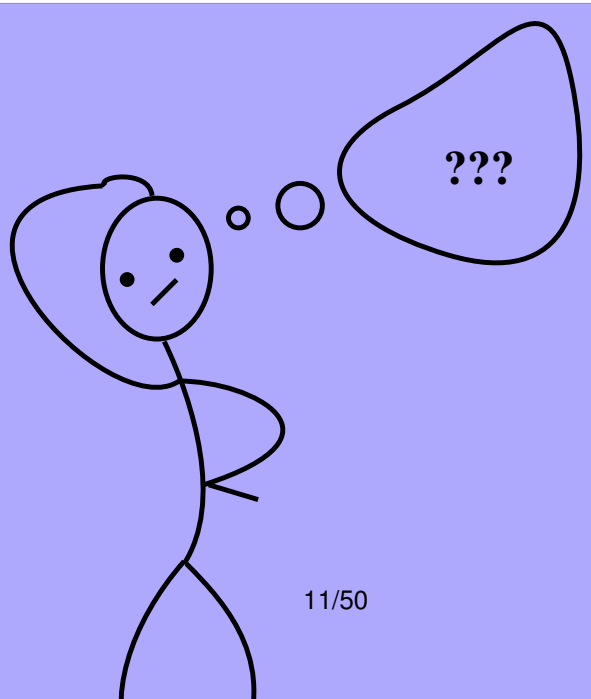

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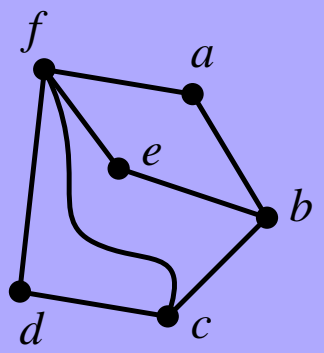

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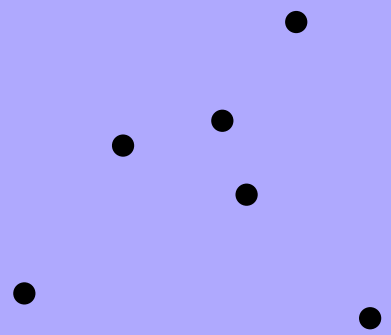

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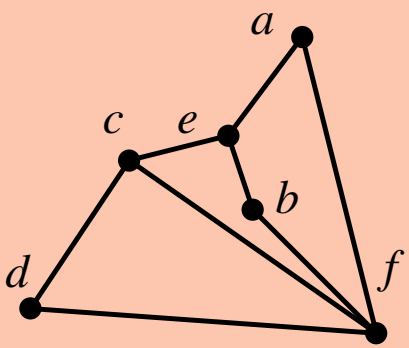

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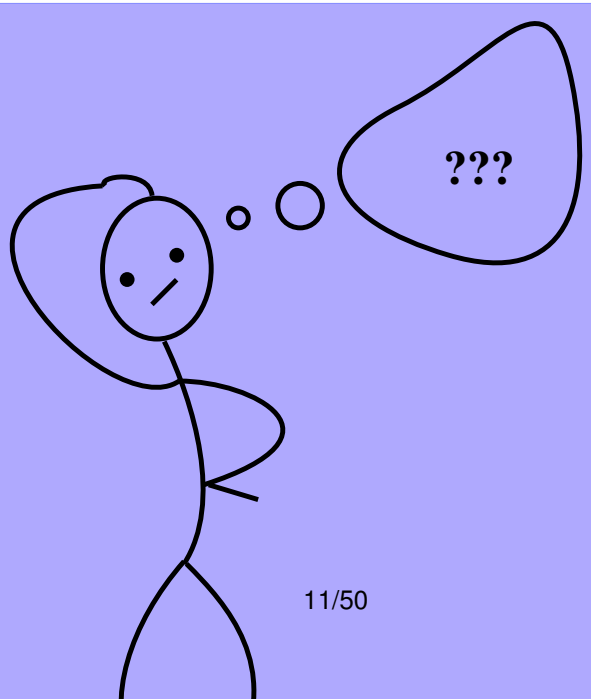

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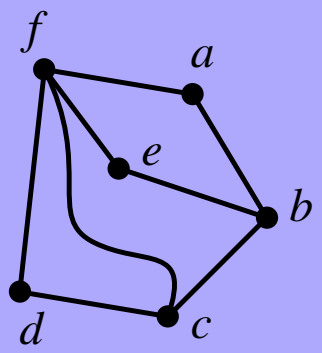

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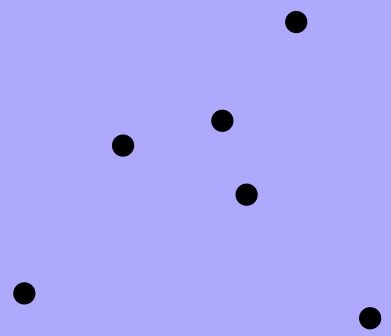

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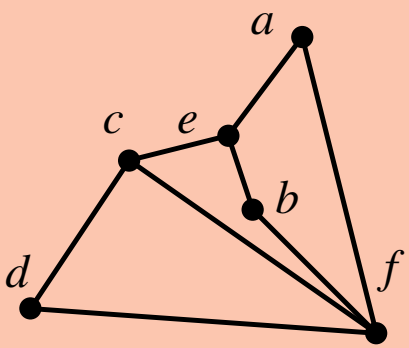

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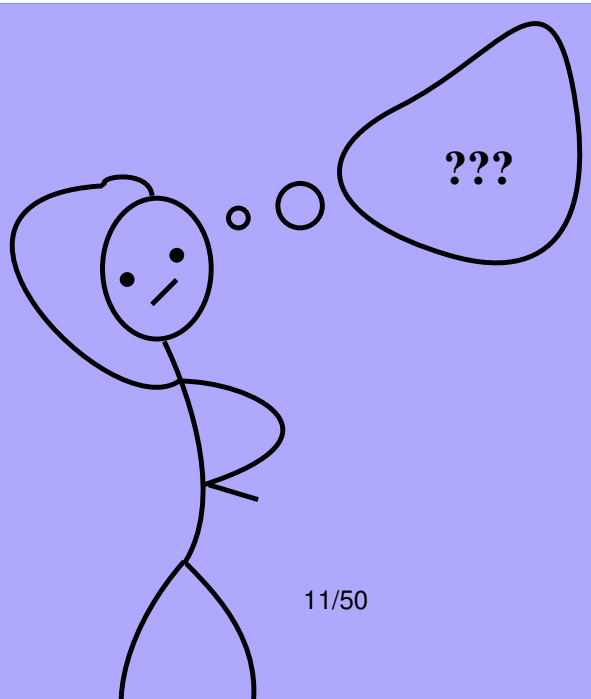

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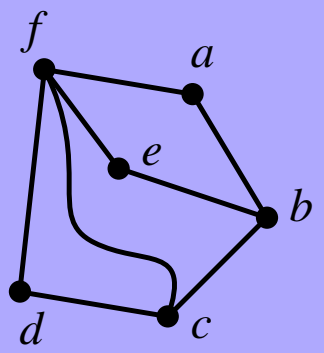

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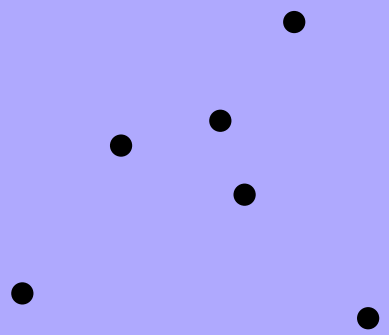

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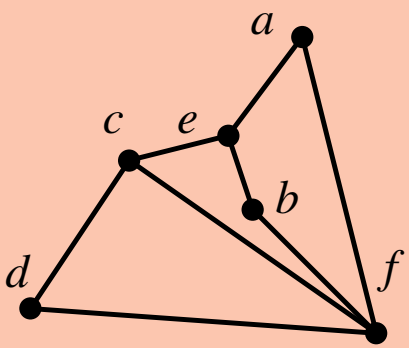

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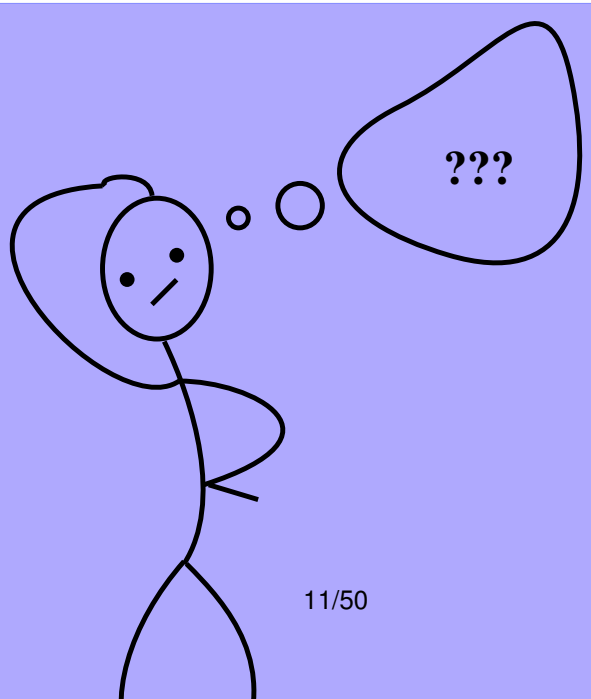

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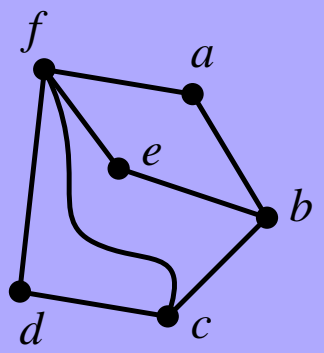
Literature Review

Opps! NP-Complete



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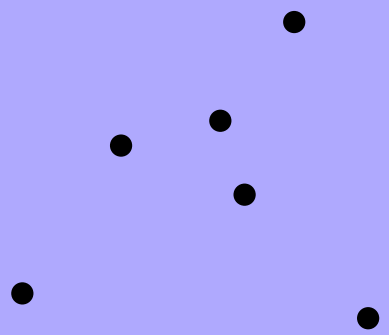

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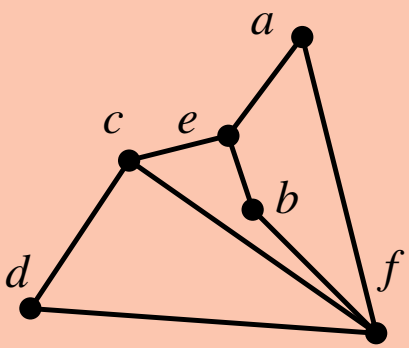

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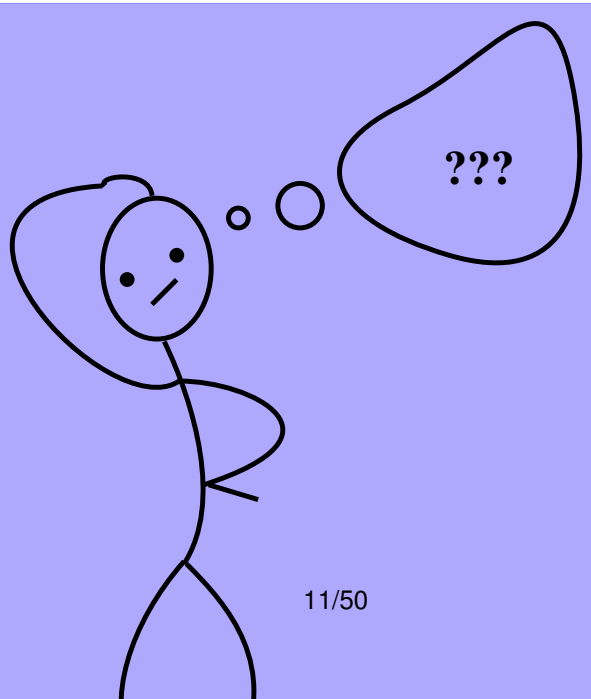

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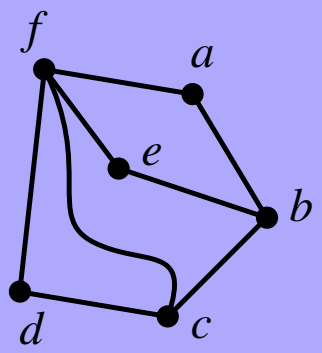

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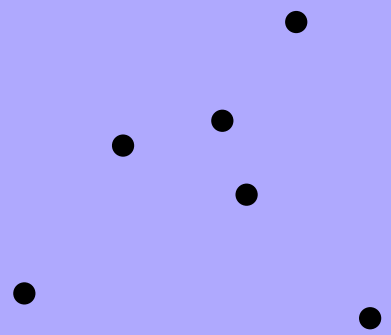

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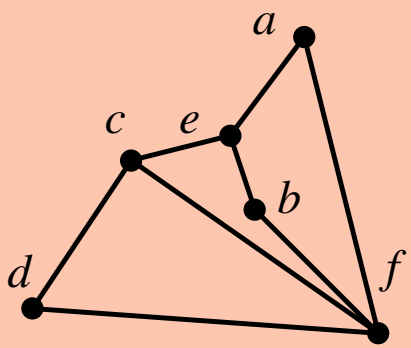

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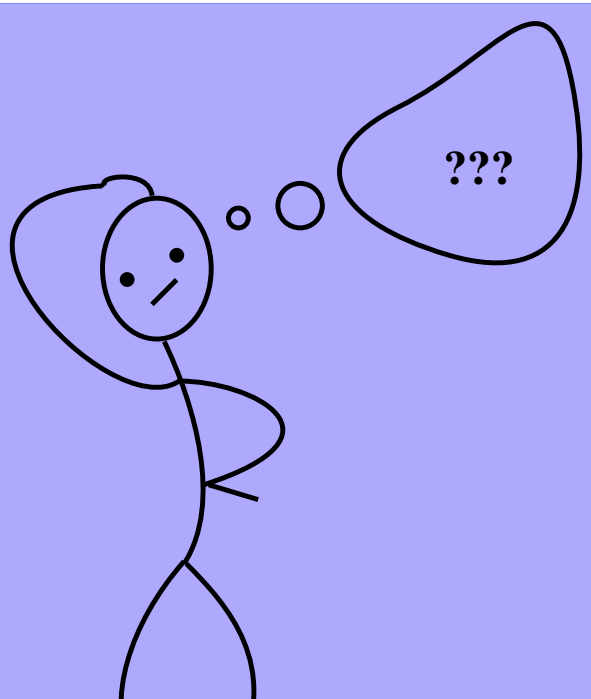

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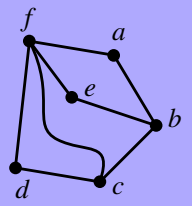
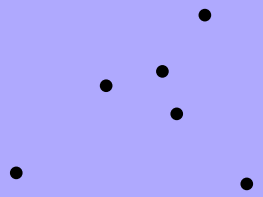


planar graph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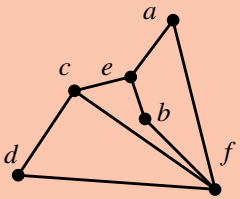
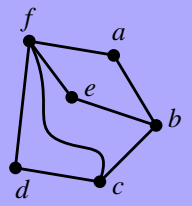


Output



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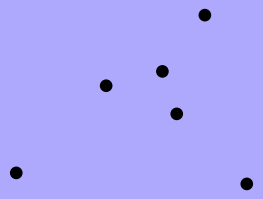

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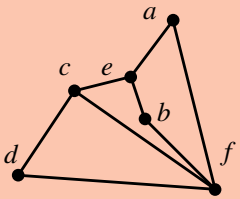

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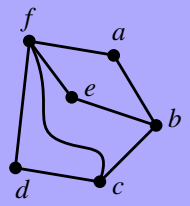

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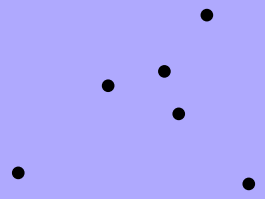
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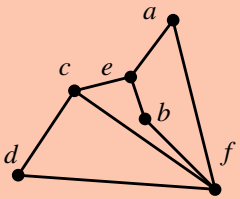

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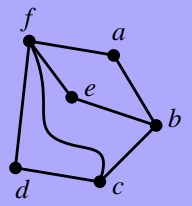
Can we solve for subclass?

tree, outerplanar, series-parallel ....



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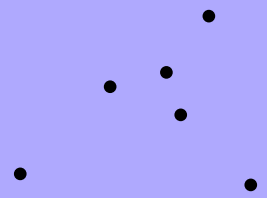
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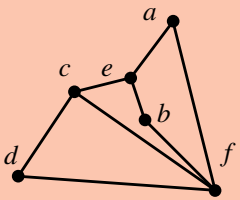

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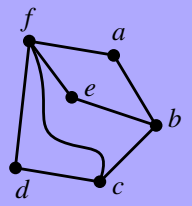
for custome restriction?

triangle free, cycle legth > 5



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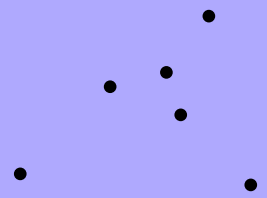
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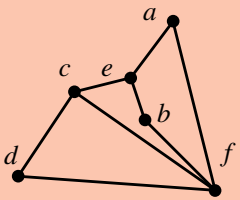

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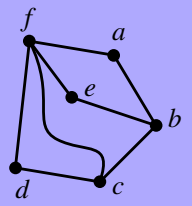

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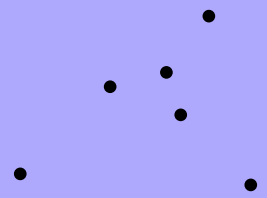
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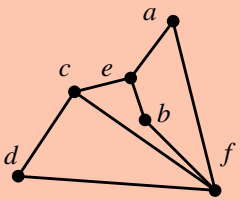

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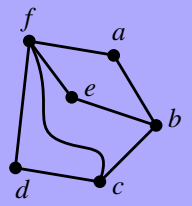

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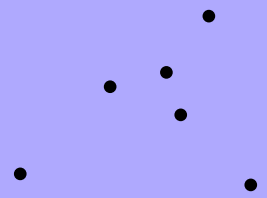
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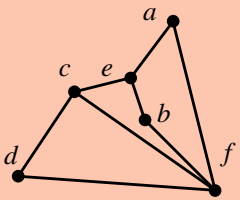

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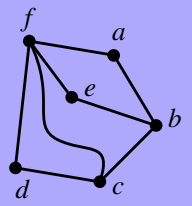

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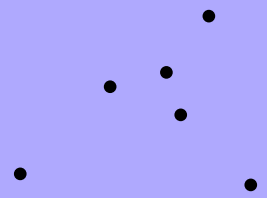
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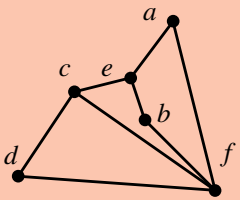

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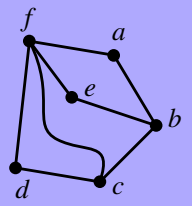

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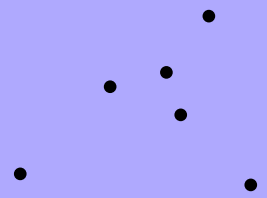
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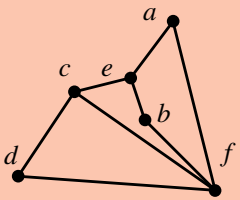

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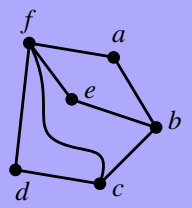

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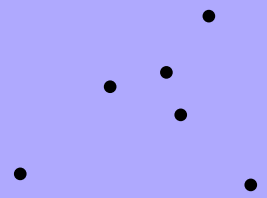
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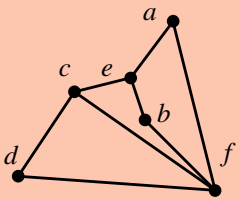

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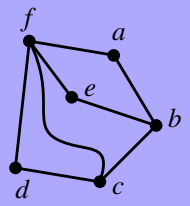

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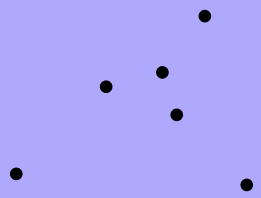

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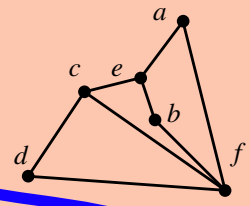

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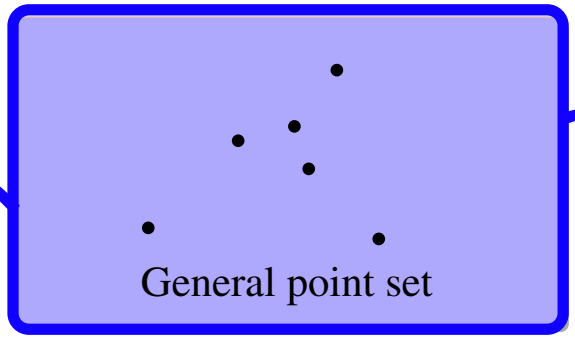

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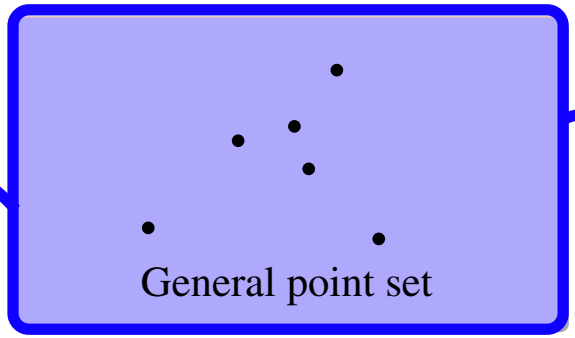

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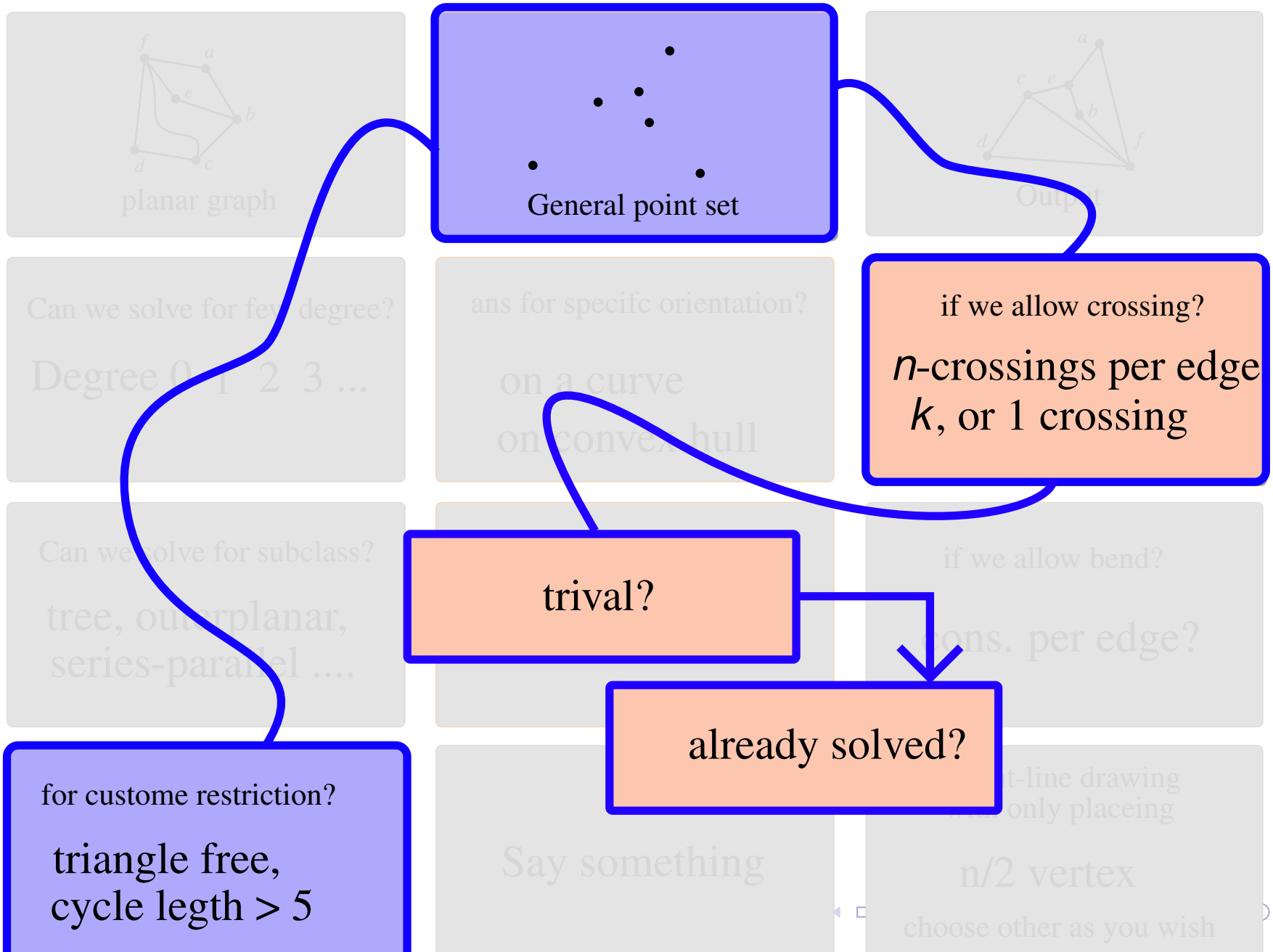
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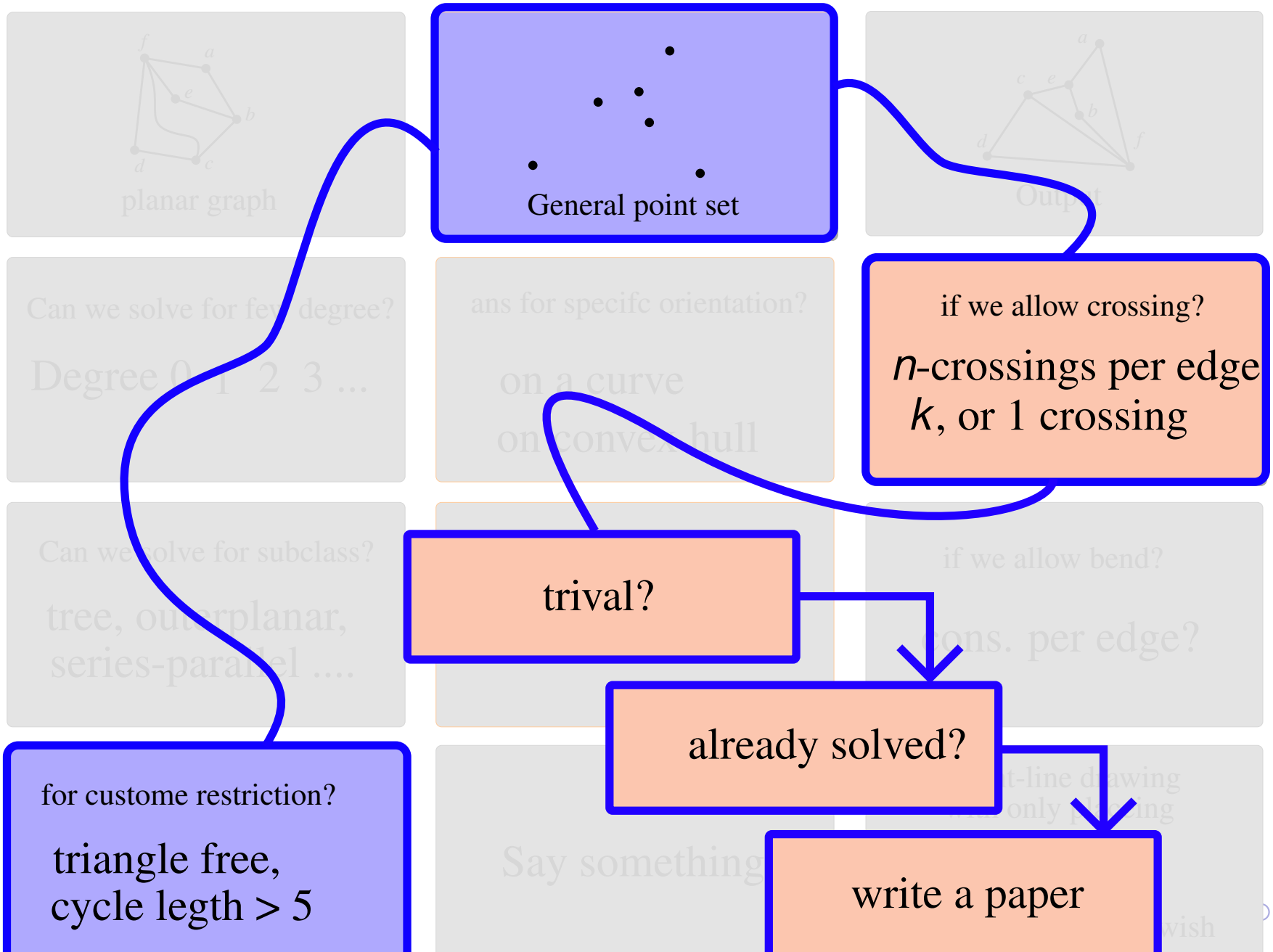
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Outline

Organization of a Research Paper

- Title
- Author/Authors Name and Affiliation
- Abstract and Key words
- Introduction
- Preliminaries / Background / Related Works
- Main Results (may be several sections)
- Conclusions
- Acknowledgement
- References
- Appendix

Title of a Paper

- The title should convey some information to the reader.

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- The title should tell the reader exactly what the paper is about and, further, what points it makes.

Authors Name

Name: At the beginning of your career, pick a name for yourself and stick to it.
Md. Saidur Rahman
M. S. Rahman
Md. S. Rahman

Authors Name

Name: At the beginning of your career, pick a name for yourself and stick to it.
Md. Saidur Rahman
M. S. Rahman
Md. S. Rahman

Wrong	Correct
Dr. Md. Saidur Rahman	Md. Saidur Rahman
Prof. Md. Saidur Rahman	Md. Saidur Rahman

Affiliation

Affiliation:
Organization, Postal Address and Email Address

Bad	Good
Professor	Dept. of Computer Science and Engineering
Dept. of CSE	BUET, Dhaka 1000
BUET, Dhaka 1000	Bangladesh

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- **Conclusions**: What implications does the answer imply?

General features of an abstract:

- self contained.
- should not make any bibliographic reference.
- should contain a minimum number of notations.

Key Words

The key words are provided so that

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Bad Choice	Good Choice
New	Algorithm
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- give an outline of the organization of the paper.

Organization of your paper

- Plan your sections and subsections. Use a top-down writing method. Use a sentence to represent the points (paragraphs) in each subsections.
- Writing details: expand a sentence in the sketch into a paragraph.
- Keep a logical flow from section to section, paragraph to paragraph, and sentence to sentence.

Preliminaries

To make the paper self-contained

- Define the notations and definitions that will be used throughout the paper.
- Describe briefly the known methods that you will use in your method.
- State the known results as Lemmas that you will use for proving your result.
- Describe your preliminary results.

Main Results

- Plan your sections and subsections to present your main results.
- Give short and informative section names.
- Give a brief outline at the beginning of each section.
- Give intuitive idea and outline of every proof and method, and then give the details.
- Keep a logical flow from section to section, paragraph to paragraph, and sentence to sentence.

Conclusions

- Restate your contribution.
- Mention any useful implication of your results that have not mentioned earlier.
- Mention future direction of research and interesting open problems that you have found in doing this research work.

Acknowledgement

- Give thanks to anonymous reviewers and to persons who helped you in doing this work.
- Acknowledge grants or support that you have received for doing this work.

Bibliographic References

- Reference or Bibliography?

  References: List of sources that you actually cite in your paper.

  Bibliography: List of all related publications.
- Follow same style for all references.
- Each item in the list must have at least the following fields: Author(s), Title, Journal or Proceedings, Publisher, Page Numbers, Year.
- URLs do not have a publication date, hence say when accessed it last.
- Follow the style specified by the publisher.

Appendix

- Bring the materials from main chapters to Appendix which obstruct the flow and smoothness of the paper.

What to Do Once The Paper is Written?

- Revise the paper several times. How many times?

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- Check the galley proof of the paper carefully when you receive it.

Outline

Thesis Organization

Title Page
Table of Contents
Abstract (One page)
List of Figures, List of Tables
Chapter 1: Introduction (5-10 pages).
Chapter 2: Preliminaries / Background / Related Works (8-20 pages).
Chapter 3-5: Main Contents. Each chapter contains a result in theoretical thesis. For applied/experimental area these chapters are on Modeling, Methodologies, Experimentation, Results and Discussions.
Chapter 6: Conclusions and Future Work (3-6 pages).
Appendix
Bibliography
Index

Outline

Writing Tools

LaTex	For typesetting of text.
LatexDraw	For drawing figures.
Xfig	For drawing figures.

LaTex templates for submission to journals are available in journal web pages.
You can also find LaTex thesis templates in Internet.

Outline

What is Plagiarism?

Copying from other source.

What is Plagiarism?

Copying from other source.

Stealing other's idea.

What is Plagiarism?

Copying from other source.

Stealing other's idea.

Never do it. It can spoil your career.

What is Plagiarism?

You may need to mention works of others, use method of others.

What is Plagiarism?

You may need to mention works of others, use method of others.

What will you do?

What is Plagiarism?

Read and understand the work.

What is Plagiarism?

Read and understand the work.

Write in your own word (do not use verbatim copy)

What is Plagiarism?

Read and understand the work.

Write in your own word (do not use verbatim copy)

Explain with your own illustrative figures

Give proper citation

What is Plagiarism?

Read and understand the work.

Write in your own word (do not use verbatim copy)

Explain with your own illustrative figures

Give proper citation

Your own work/results should be significantly different from the cited work. You cannot use other's works as the major content of your paper.

Outline

Review Report

Writing a review report is a professional duty. Usually it a voluntary work.
A review report should contain

- Problem statement

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Writing a review report is a professional duty. Usually it a voluntary work.
A review report should contain

- Problem statement
- Contribution of the paper
- Strength and weakness of the paper
- Your recommendation
- Comments to author for improvement of the paper

Revision Report

A revision report should contain

- Thanks to the anonymous referees

Revision Report

A revision report should contain

- Thanks to the anonymous referees
- Your comments and action addressing each point raised by the reviewers.

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Outline

Your Venue for Publishing

Always try to publish your research articles in good journals and conferences!!

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Always try to publish your research articles in good journals and conferences!!

How do you find a good venue?

Your Venue for Publishing

Always try to publish your research articles in good journals and conferences!!

How do you find a good venue?

Very difficult problem now a days.

Your Venue for Publishing

ISI (Institute for Scientific Information) Indexed

Your Venue for Publishing

ISI (Institute for Scientific Information) Indexed

Impact Factor

Your Venue for Publishing

ISI (Institute for Scientific Information) Indexed

Impact Factor

Journal	Impact Factor
Information Systems	1.456
Algorithmica	.79
SIAM Journal on Computing	.74

Bibliographic Databases

- Google Scholar
- DBLP: Computer Science Bibliography
- SCImago Journal and Conference Rank

Digital Repository

- Science Direct
- ACM Digital Library
- IEEE Xplore

Outline

Concluding Remarks

- Always try to do quality research.
- One good publication is better than dozens of poor publications.
- You cannot regain your reputation by publishing 20 good publications if you damage your image by publishing only one bad paper.
- Do not publish review/survey paper unless you are an expert of the field.

Concluding Remarks

Publish your research results in good journals.

Concluding Remarks

Publish your research results in good journals.

But do not publish a journal !!!!

Acknowledgement

- Sources:
  - D. E. Knuth, T. Larrabee and P. M. Robers, Mathematical Writing, MAA Notes, 14, The Mathematical Association of America, 1989.
  - S. G. Krantz, A primer of Mathematical Writing, American Mathematical Society, 1997.
  - G. Polya, How to Solve It, Princeton University Press, 1945.
  - R. Andonie and I. Dzitac, How to write a good paper in computer science and how will it be measured by ISI web of knowledge, Int. J. of Computers, Communications & Control, 4, pp. 432-446, 2010.
  - U. Khedker, How to Write a Good Paper? Indian Institute of Technology, Bombay (slides).
  - https://cs.uwaterloo.ca/ brecht/thesis-hints.html, accessed on August 29, 2013.

Thank You

Thank you for your attention.