Topics

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Discrete Mathematics

Elementary and Beyond

With 95 Illustrations

4
Fibonacci Numbers

In the thirteenth century, the Italian mathematician Leonardo Fibonacci studied the following (not too realistic) question:

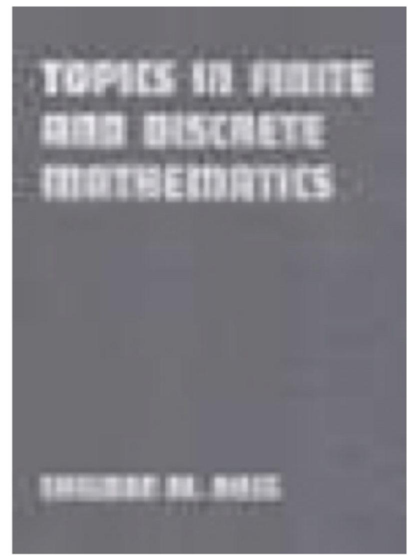
Leonardo Fibonacci

A farmer raises rabbits. Each rabbit gives birth to one rabbit when it turns 2 months old, and then to one rabbit each month thereafter. Rabbits never die, and we ignore male rabbits. How many rabbits will the farmer have in the nth month if he starts with one newborn rabbit?

Graphs

8 Trees

10 Matchings in Graphs



Topics in Finite and Discrete Mathematics

Sheldon M. Ross

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Chapter

3 - Probability pp. 70-96

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Sections 1-5

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5 - Graphs and Trees pp. 124-149 Sections 1-5

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7 - Linear Programming pp. 180-202 Sections 1-4

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8 - Sorting and Searching pp. 203-219 Sections 1,2-6

4. Mathematics of Finance

Sections 1-5

4.1 Interest Rates

If you borrow the amount P (called the principal) which must be repaic at time T along with simple interest at rate r per time T, then the amoun to be repaid at time T is

$$P + rP = (1 + r)P.$$

$$P \lim_{n\to\infty} (1 + r/n)^n = Pe^r,$$

where e, the base of the natural logarithm, is defined by

$$e = \lim_{n\to\infty} (1 + 1/n)^n$$

and is approximately given by $e \approx 2.71828\ldots.$

Chapter

5 - Graphs and Trees pp. 124-149

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Sections 1-5

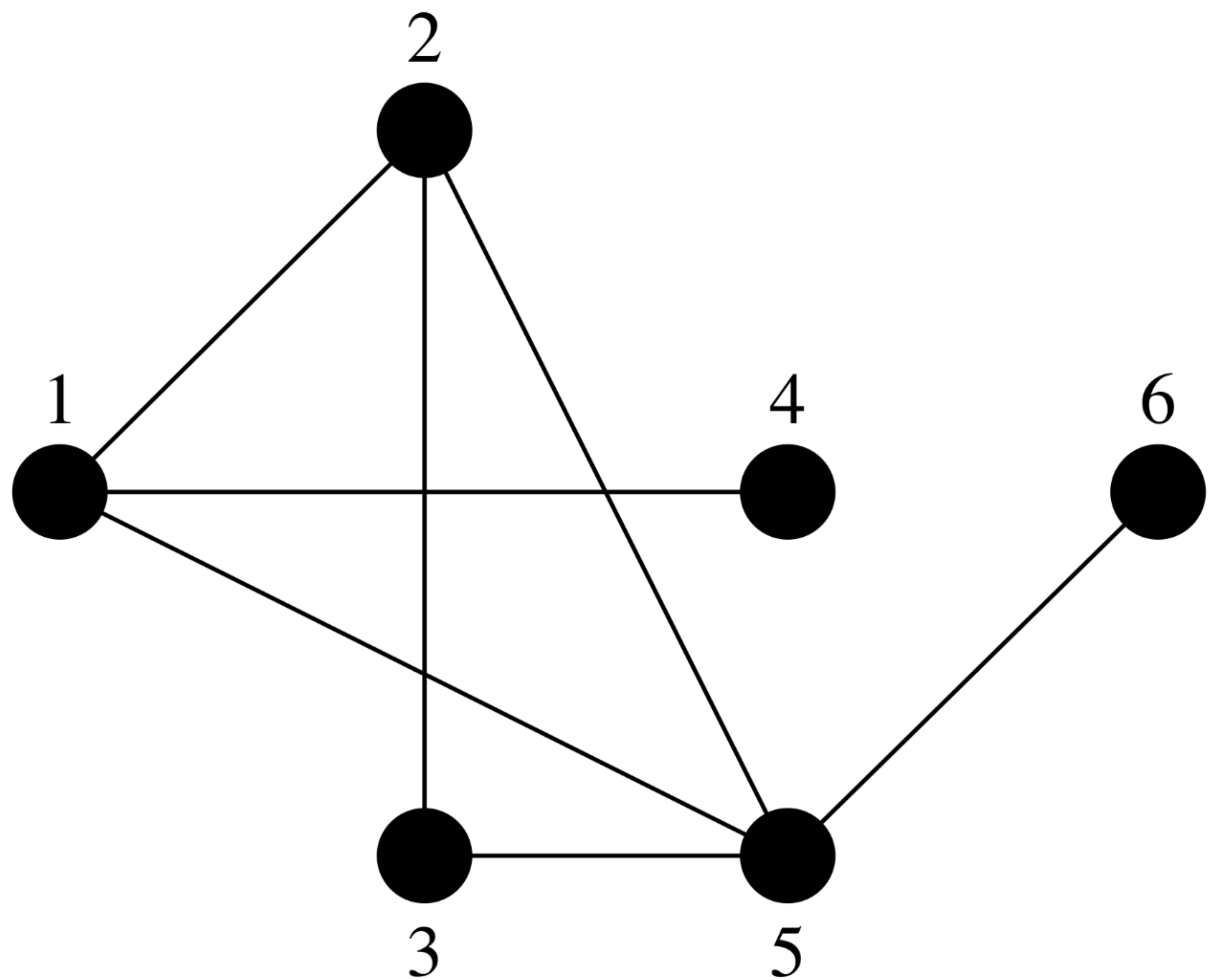

Figure 5.1: A Graph

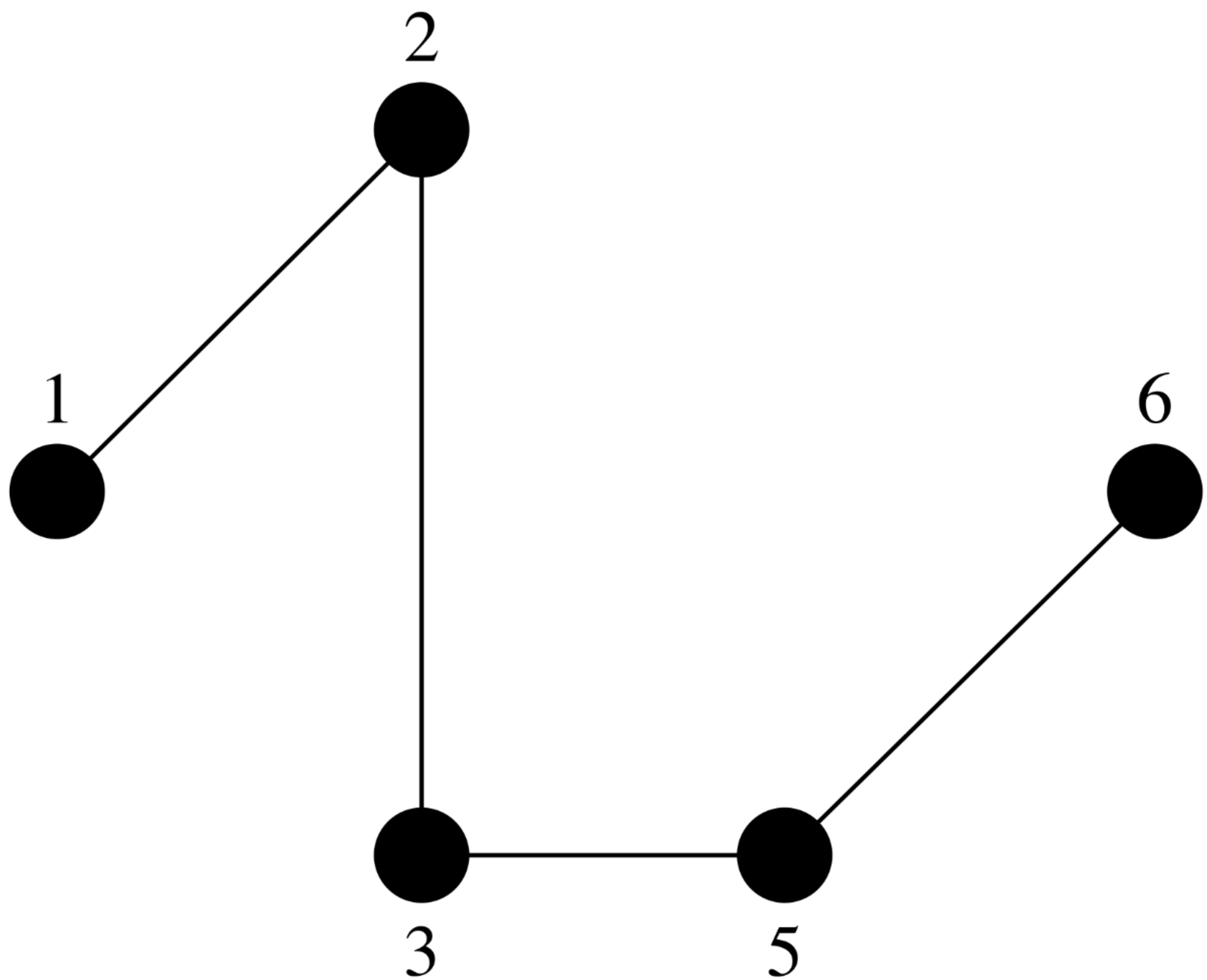

Figure 5.2: A Path from 1 to 6: 1, 2, 3, 5, 6

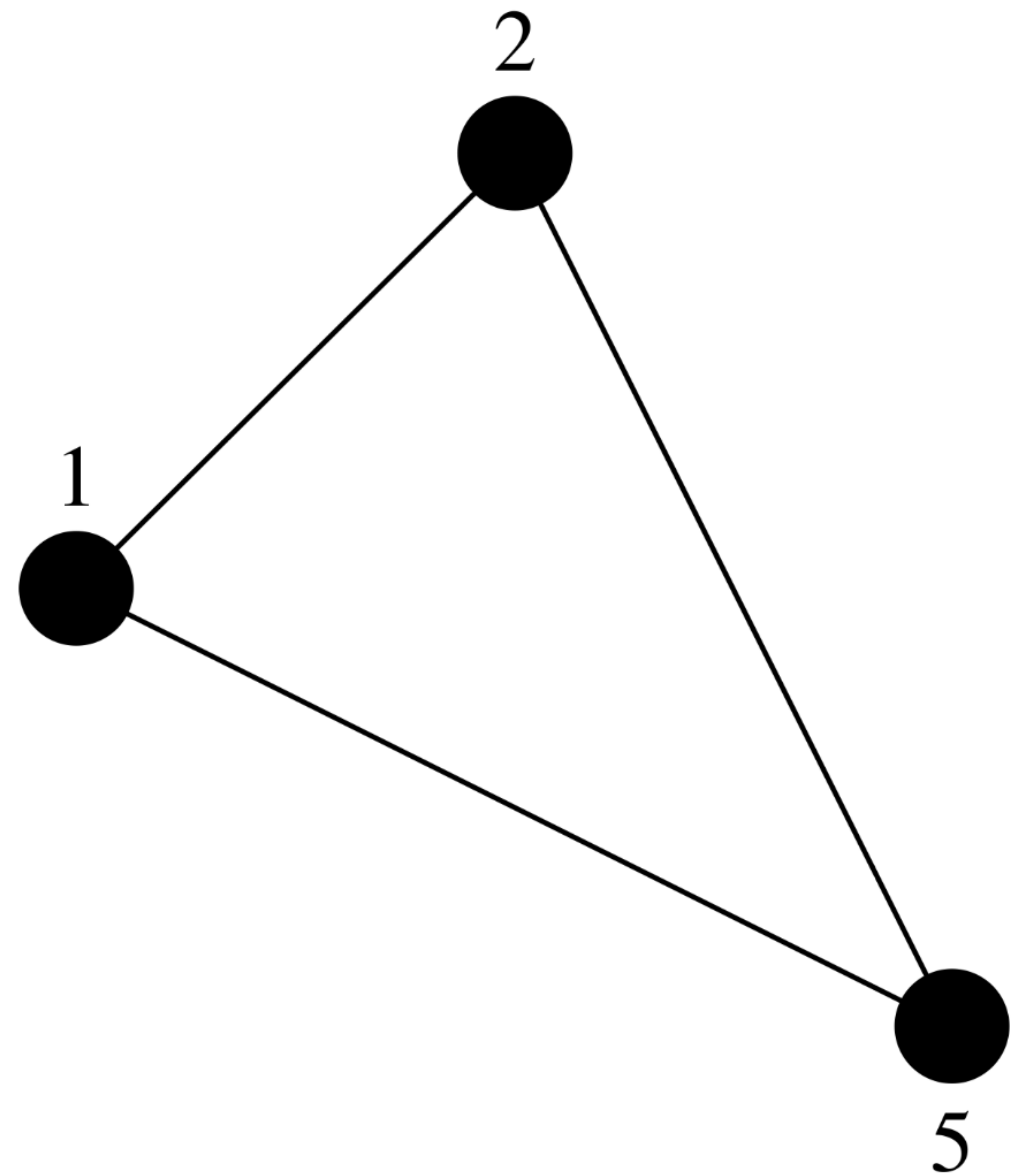

Figure 5.3: A Cycle: 1, 2, 5, 1

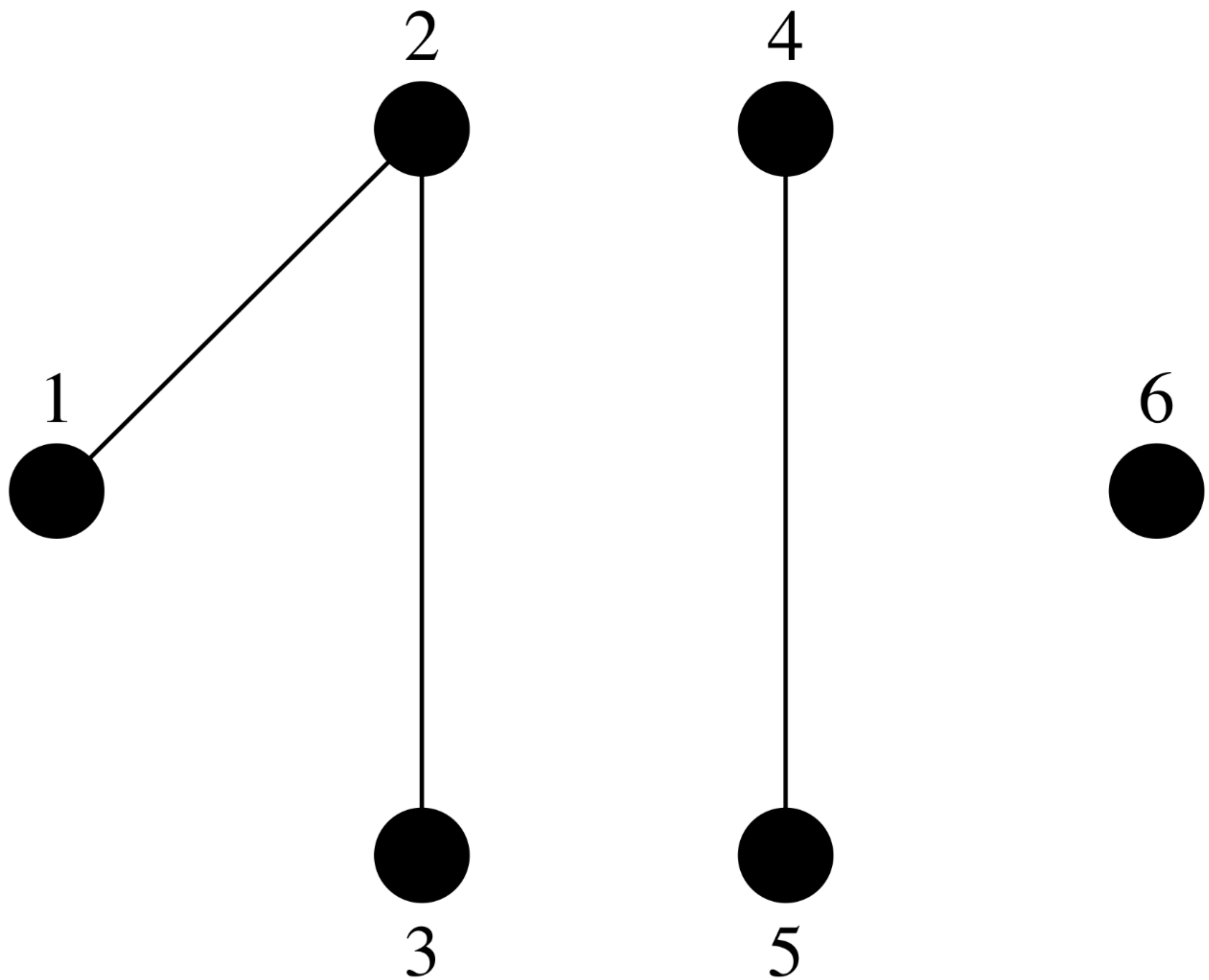

Figure 5.4: A Graph with Three Components

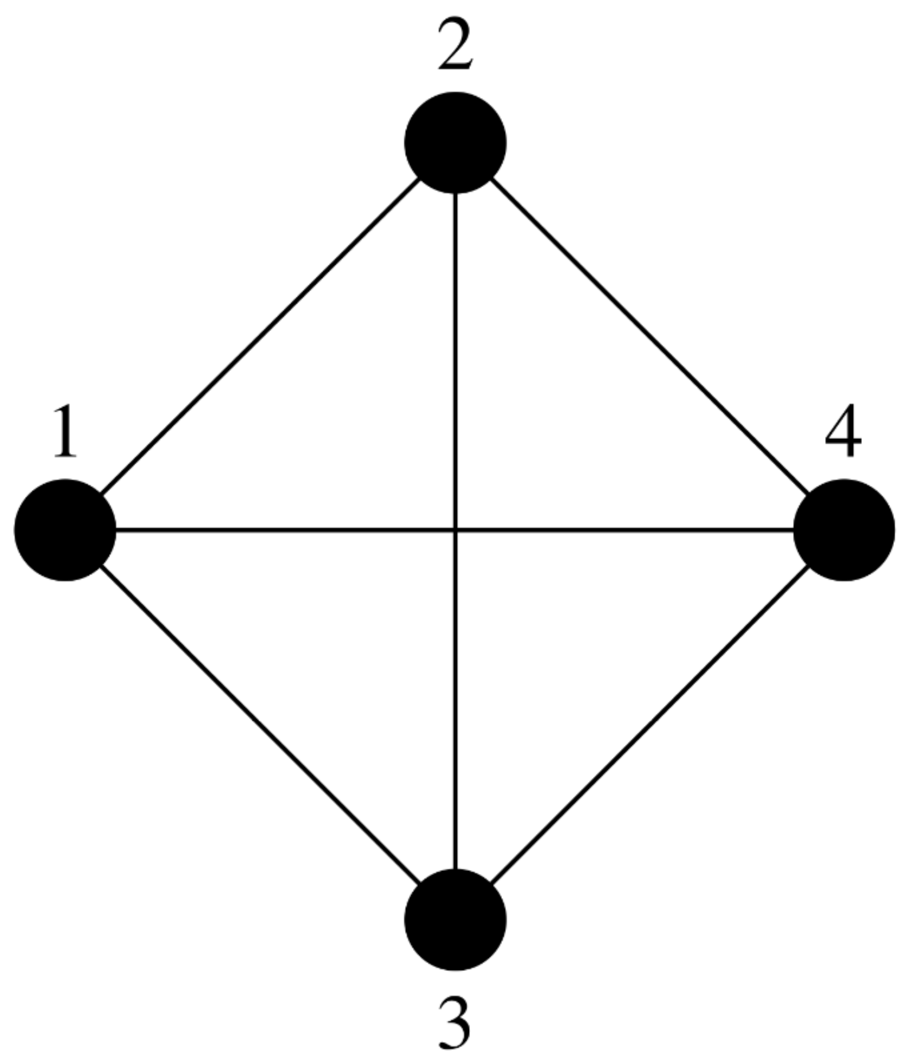

Figure 5.5: The Complete Graph on Four Vertices

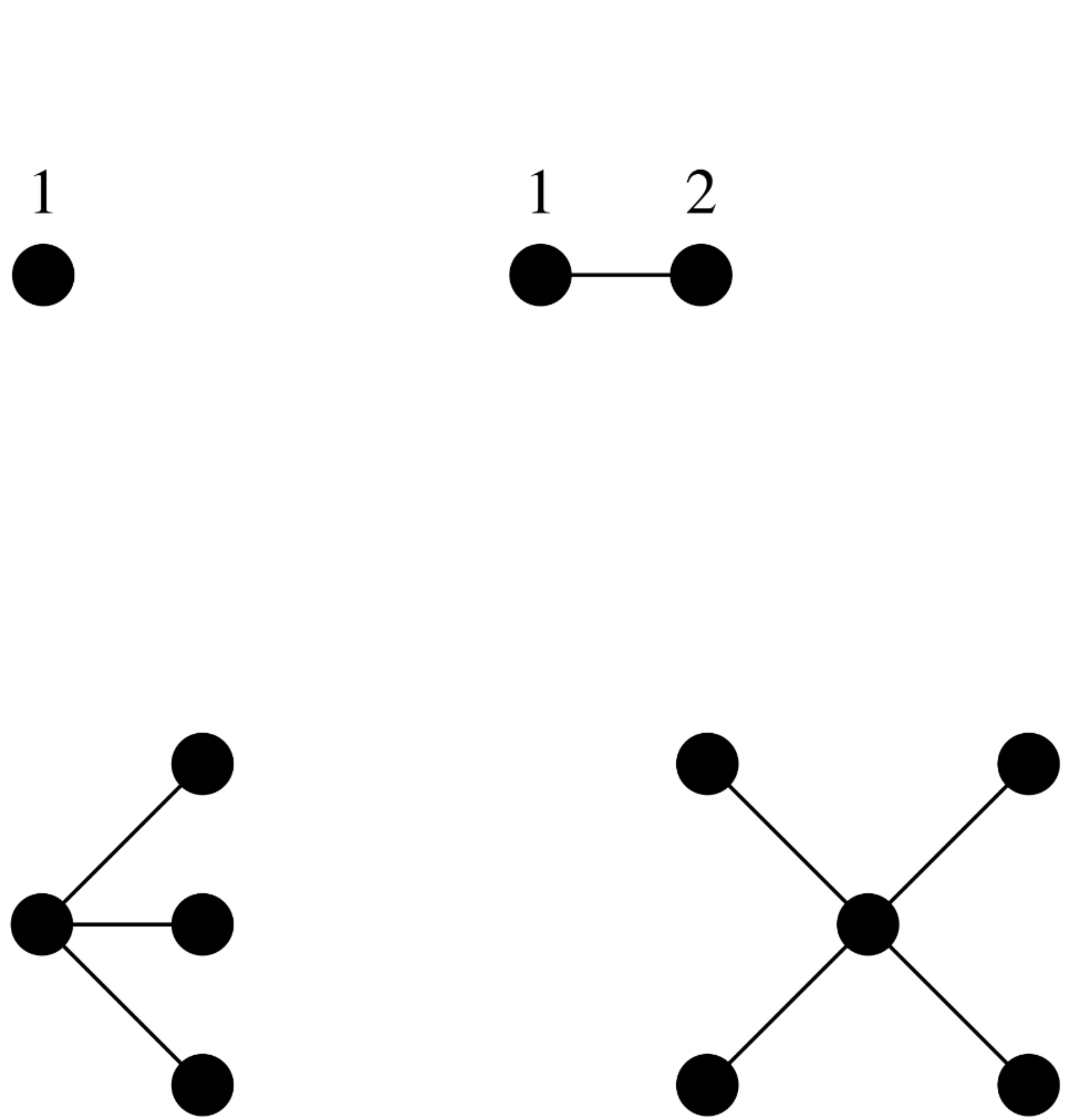

Figure 5.6: Trees

Chapter

6 - Directed Graphs pp. 150-179

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Sections 1-4

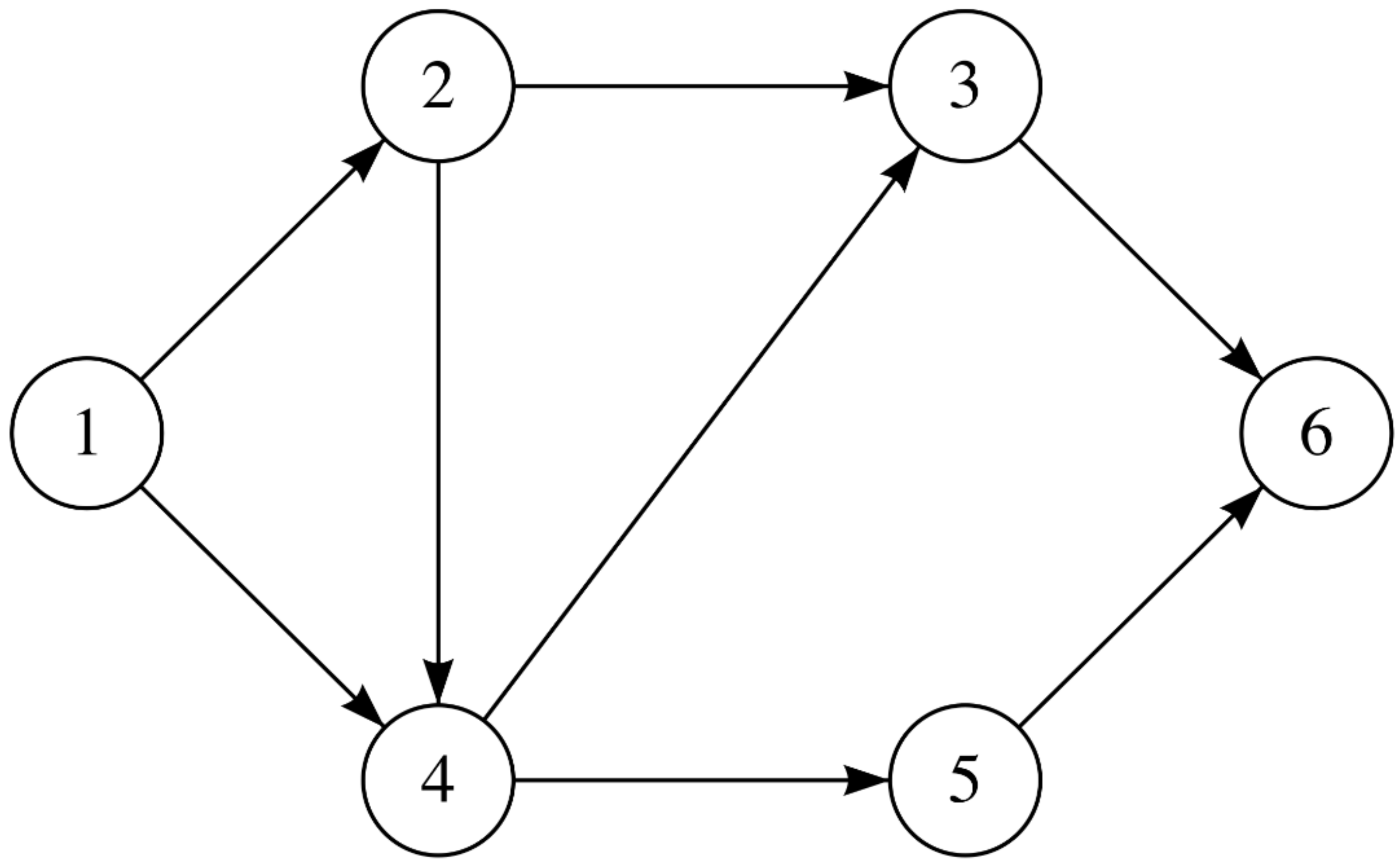

Figure 6.1: Directed Graph with

$\mathcal{A} = \{(1, 2), (1, 4), (2, 3), (2, 4), (3, 6), (4, 3), (4, 5), (5, 6)\}$

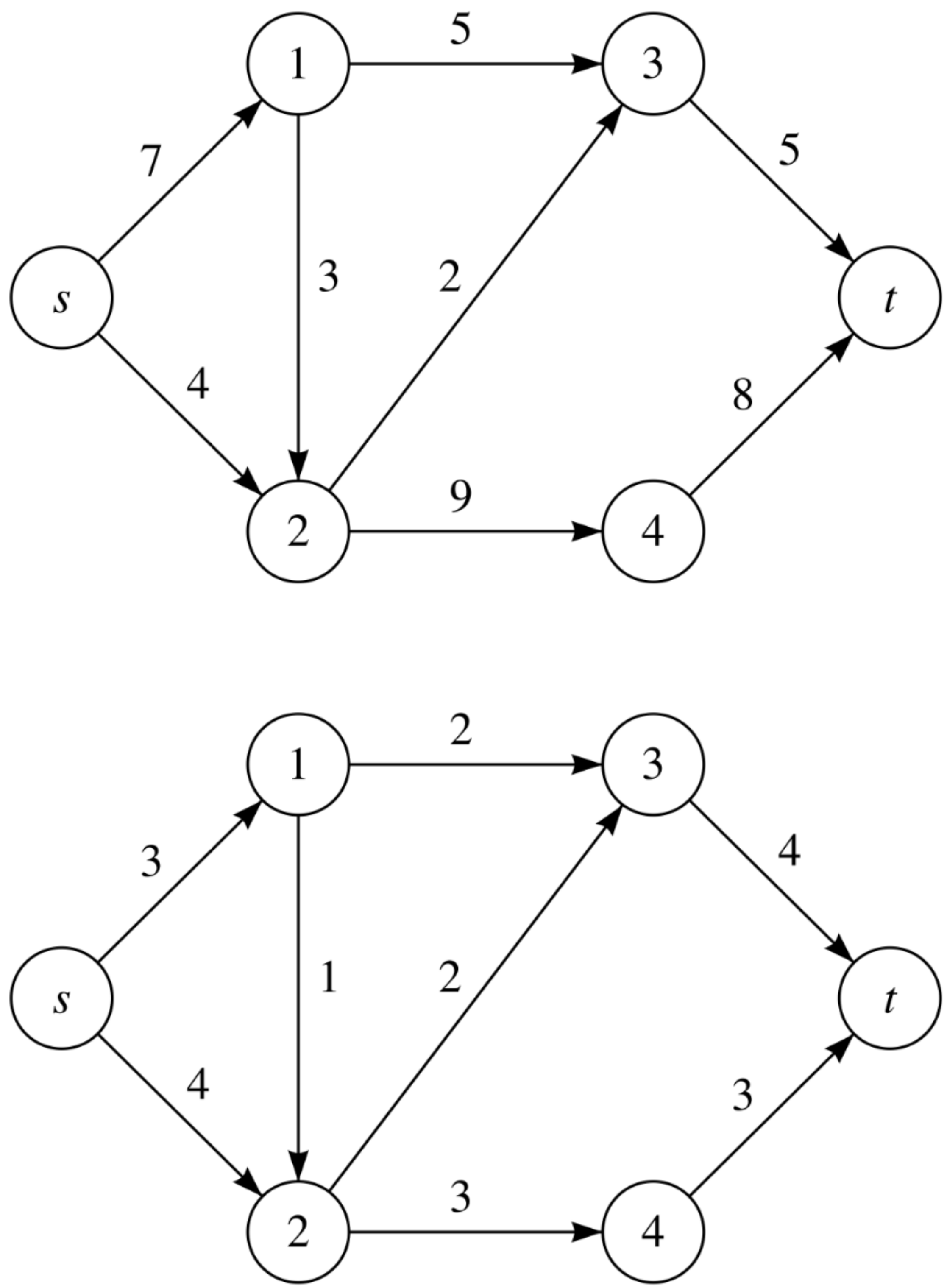

Figure 6.2: Edge Capacities and a Feasible Flow

Theorem 6.2.1 (Max-Flow Min-Cut Theorem)

$$\max_f v(f) = \min c(X, \bar{X}).$$

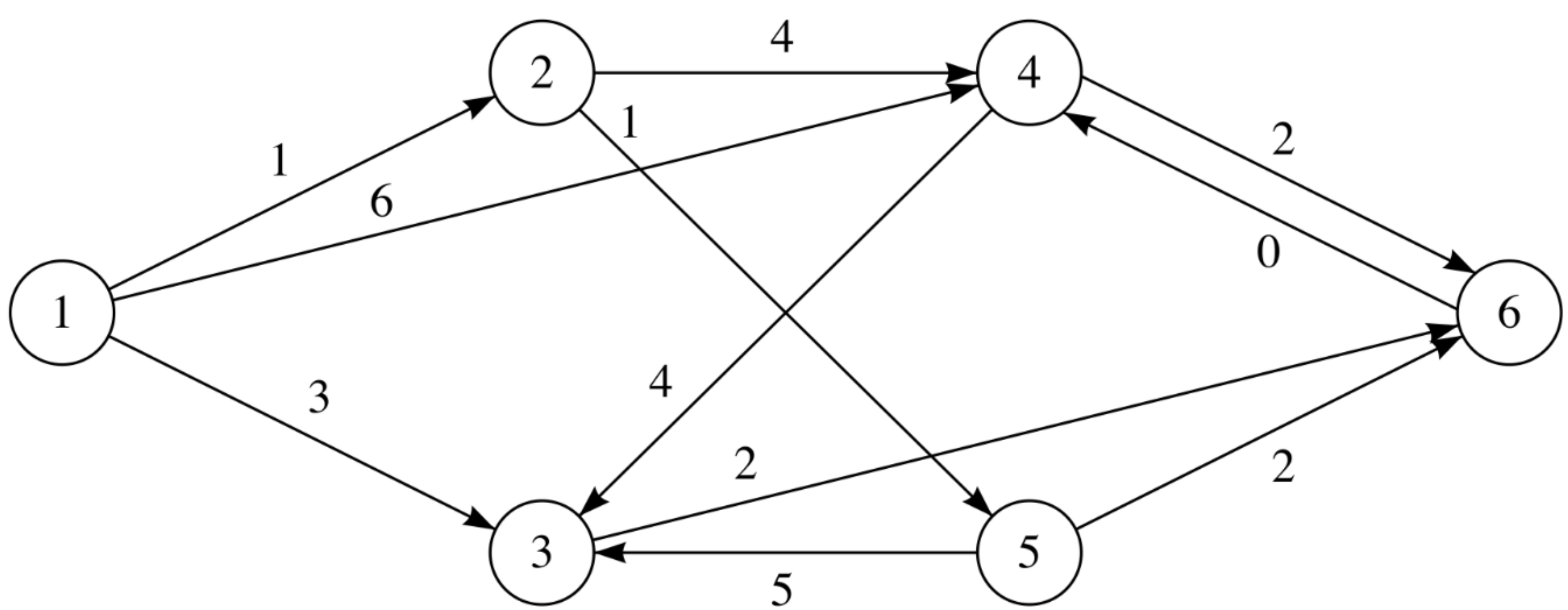

Figure 6.15: A Directed Graph with Costs

For instance, in the directed graph depicted in Figure 6.15, interpret-
ing the numbers on the … e edge distances yields that
the length of the path 1 … from vertex 1 to vertex 6 is

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7 - Linear Programming pp. 180-202

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Sections 1-4

$$\text{maximize } \; 1 + x_1 + x_2 + x_3$$

subject to

$$
\begin{aligned}
1 - x_1 &\geq 0,\\
1 - 3x_1 - x_2 &\geq 0,\\
1 + x_1 - 3x_2 - x_3 &\geq 0,\\
1 + x_1 + x_2 - 3x_3 &\geq 0;
\end{aligned}
$$

$$x_1 \geq 0, \quad x_2 \geq 0, \quad x_3 \geq 0.$$

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Chapter

8 - Sorting and Searching pp. 203-219

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Sections 1,2-6

$$5\ 3\ 8\ 7\ 0\ 9\ 6\ 4\ 1,$$

then (with the bar indicating the value that is to be compared with its immediate follower) the successive orderings in the first pass are as follows:

$$3\ \bar{5}\ 8\ 7\ 0\ 9\ 6\ 4\ 1,$$

$$3\ 5\ \bar{8}\ 7\ 0\ 9\ 6\ 4\ 1,$$

$$3\ 5\ 7\ \bar{8}\ 0\ 9\ 6\ 4\ 1,$$

$$3\ 5\ 7\ 0\ \bar{8}\ 9\ 6\ 4\ 1,$$

$$3\ 5\ 7\ 0\ 8\ \bar{9}\ 6\ 4\ 1,$$

$$3\ 5\ 7\ 0\ 8\ 6\ \bar{9}\ 4\ 1,$$

$$3\ 5\ 7\ 0\ 8\ 6\ 4\ \bar{9}\ 1,$$

$$3\ 5\ 7\ 0\ 8\ 9\ 4\ 1\ 9.$$