

# Discrete Optimization

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Name:

## 1 Test sample

**Comment:** This is a sample of questions that may or may not appear in the final test. There topics that are not covered in this sample. This does not mean they they will not be covered in the final.

We will discuss in class tomorrow what and how to answer these questions or similar questions in the final.

1. What is graph isomorphism?  
How many non-isomorphic graphs with 9 vertices, regular of degree 6 are there?
2. Construct a labeled tree whose Prüfer code is  $[3, 2, 3, 2, 3, 2, 3, 2]$ .  
Are two trees whose Prüfer code has 4 6's and 4 4's isomorphic as (non-labeled) trees?
3. Let  $G$  be a graph with chromatic number  $\chi(G) = k > 1$  and Chromatic index  $\chi_1(G) = \Delta(G)$ . Prove that  $G_1$ , the prism over  $G$  has chromatic number  $k$  and  $\chi(G_1) = \Delta(G_1)$ .
4. Can you construct a 7-regular graph that has no triangles with chromatic number 3?
5. Is it possible to design a network topology of diameter 3 for 20 computers where each computer is connected to 4 other computers?
6. Prove that the edges of a bipartite graph  $G$  can be colored by  $\Delta(G)$  colors.

8. In the following assignment problem describe the steps you will execute to find the minimal cost assignment. (Note: as a practice, just write the exact steps. In a real test, after each properly described step, you will be provided upon request, the result of this step).

16 16 68 72 83 74 55 18 19 86 75 35 62 23 10 28 66 44 54 46  
74 25 75 79 70 28 88 50 53 47 79 66 41 15 50 37 64 57 62 19  
85 71 66 39 41 65 69 13 54 24 52 86 27 39 55 36 11 43 49 41  
24 31 21 78 61 11 15 61 27 10 48 43 13 25 76 52 82 70 59 46  
16 27 63 86 37 52 88 35 89 13 60 26 84 39 52 83 41 50 23 73  
32 35 78 52 21 89 81 88 72 13 39 58 50 53 19 19 53 40 19 48  
63 37 51 23 39 82 60 10 39 53 25 35 49 21 77 62 83 25 79 81  
27 81 26 22 89 46 21 28 27 17 35 49 35 49 81 48 31 39 18 47  
70 78 20 85 59 68 61 55 87 62 49 88 48 33 34 82 21 54 84 45  
60 43 24 54 22 63 38 30 75 64 28 38 24 14 82 32 28 23 47 66  
49 89 44 40 24 57 81 41 32 41 53 85 43 48 86 79 80 53 23 29  
19 49 20 86 86 89 80 74 59 71 10 48 70 78 55 38 56 39 12 85  
54 70 74 79 31 35 26 55 15 76 52 18 47 65 10 77 60 22 31 14  
40 58 26 54 81 45 11 54 74 81 55 60 58 70 34 86 84 16 30 41  
53 23 14 57 49 85 58 71 45 83 79 39 31 86 53 13 13 49 57 64  
10 73 57 66 19 16 77 37 48 11 28 29 42 36 29 74 82 83 50 42  
60 34 25 36 15 43 80 26 49 21 37 40 37 28 76 36 80 50 48 32  
25 37 36 61 81 88 11 44 79 75 46 89 34 18 56 65 20 29 19 25  
43 63 12 41 81 49 84 27 87 62 45 45 29 62 70 85 18 26 36 69  
54 33 61 18 25 48 62 13 37 18 57 26 46 61 38 82 78 67 57 13