

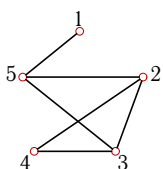
## Размещение вершин графа на линейке

Найти наилучшее размещение графа на линейке после трех циклов генетического алгоритма. Качество размещения оценивается суммой<sup>1</sup>

$$L = \sum_i^5 \sum_j^5 d_{ij} a_{ij},$$

где  $d_{ij}$  — расстояние (в ребрах) по линейке между вершинами  $v_i$  и  $v_j$ ,  $a_{ij}$  — соответствующий элемент матрицы смежности (0 или 1). На каждом этапе  $k = 1, 2, 3$  эволюции на хромосому  $h_i = [v_1, v_2, \dots, v_5]$  с лучшим качеством действует оператор мутации  $R_k$  инверсионного типа, генерирующий хромосому  $h'_i = [v_1, v_2, \dots, v_k, v_5, \dots, v_{k+1}]$ . Хромосома с худшим качеством удаляется из популяции. Найти  $\min L$ . При равных качествах хромосом предпочтение отдается хромосоме с меньшим номером.

**Задача 15.1.**



- 1) 

1	2	3	4	5
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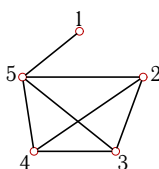
  
 2) 

2	1	3	4	5
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 3) 

5	2	3	4	1
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**Задача 15.2.**



- 1) 

1	2	3	4	5
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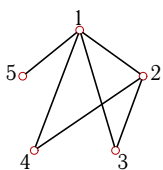
  
 2) 

2	1	3	4	5
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 3) 

5	2	3	4	1
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**Задача 15.3.**



- 1) 

1	2	3	4	5
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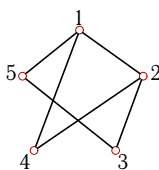
  
 2) 

2	1	3	4	5
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 3) 

5	2	3	4	1
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**Задача 15.4.**



- 1) 

1	2	3	4	5
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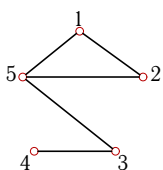
  
 2) 

2	1	3	4	5
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 3) 

5	2	3	4	1
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**Задача 15.5.**



- 1) 

1	2	3	4	5
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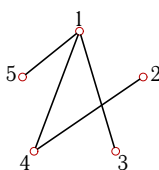
  
 2) 

2	1	3	4	5
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 3) 

5	2	3	4	1
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**Задача 15.6.**



- 1) 

1	2	3	4	5
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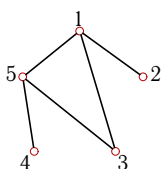
  
 2) 

2	1	3	4	5
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 3) 

5	2	3	4	1
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**Задача 15.7.**



- 1) 

1	2	3	4	5
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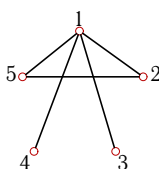
  
 2) 

2	1	3	4	5
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 3) 

5	2	3	4	1
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**Задача 15.8.**



- 1) 

1	2	3	4	5
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 2) 

2	1	3	4	5
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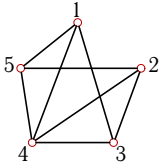
  
 3) 

5	2	3	4	1
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<sup>1</sup>Емельянов В.В., Курейчик В.М., Курейчик В.В. Теория и практика эволюционного моделирования. — М.: ФИЗМАТЛИТ, 2003

**Задача 15.9.**

1



- 1) 

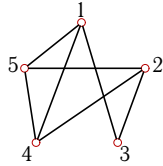
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

1	5	3	4	2
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**Задача 15.10.**

1



- 1) 

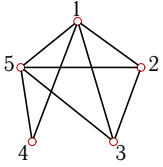
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

5	2	3	4	1
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**Задача 15.11.**

1



- 1) 

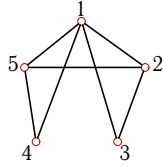
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

1	5	3	4	2
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**Задача 15.12.**

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- 1) 

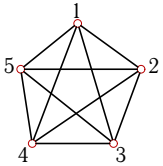
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

1	5	3	4	2
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**Задача 15.13.**

1



- 1) 

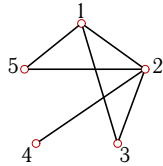
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

1	5	3	4	2
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**Задача 15.14.**

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- 1) 

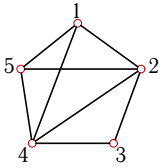
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

5	2	3	4	1
---	---	---	---	---

**Задача 15.15.**

1



- 1) 

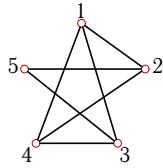
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

5	2	3	4	1
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**Задача 15.16.**

1



- 1) 

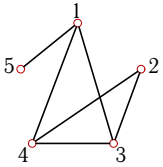
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

1	5	3	4	2
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**Задача 15.17.**

1



- 1) 

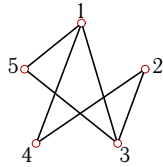
1	2	3	4	5
---	---	---	---	---
- 2) 

2	1	3	4	5
---	---	---	---	---
- 3) 

5	2	3	4	1
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**Задача 15.18.**

1



- 1) 

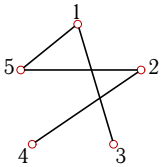
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

5	2	3	4	1
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**Задача 15.19.**

1



- 1) 

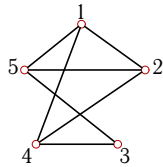
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

1	5	3	4	2
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**Задача 15.20.**

1



- 1) 

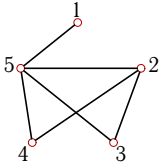
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

1	5	3	4	2
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**Задача 15.21.**

1



- 1) 

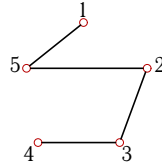
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

5	2	3	4	1
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**Задача 15.22.**

1



- 1) 

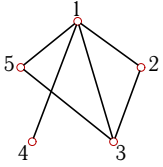
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

1	5	3	4	2
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**Задача 15.23.**

1



- 1) 

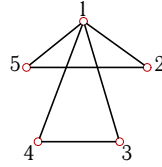
1	2	3	4	5
---	---	---	---	---
- 2) 

2	1	3	4	5
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- 3) 

5	2	3	4	1
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**Задача 15.24.**

1



- 1) 

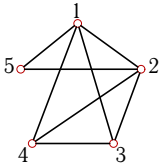
1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

5	2	3	4	1
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**Задача 15.25.**

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- 1) 

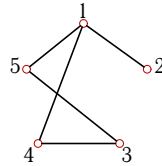
1	2	3	4	5
---	---	---	---	---
- 2) 

2	1	3	4	5
---	---	---	---	---
- 3) 

5	2	3	4	1
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**Задача 15.26.**

1



- 1) 

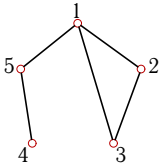
1	2	3	4	5
---	---	---	---	---
- 2) 

2	1	3	4	5
---	---	---	---	---
- 3) 

5	2	3	4	1
---	---	---	---	---

**Задача 15.27.**

1



- 1) 

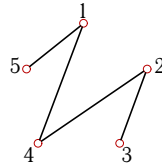
1	2	3	4	5
---	---	---	---	---
- 2) 

2	1	3	4	5
---	---	---	---	---
- 3) 

5	2	3	4	1
---	---	---	---	---

**Задача 15.28.**

1



- 1) 

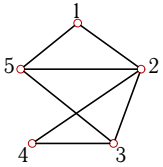
1	2	3	4	5
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- 2) 

2	1	3	4	5
---	---	---	---	---
- 3) 

5	2	3	4	1
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**Задача 15.29.**

1



- 1) 

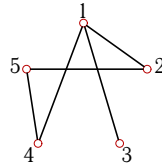
1	2	3	4	5
---	---	---	---	---
- 2) 

2	1	3	4	5
---	---	---	---	---
- 3) 

1	5	3	4	2
---	---	---	---	---

**Задача 15.30.**

1



- 1) 

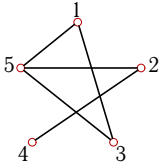
1	2	3	4	5
---	---	---	---	---
- 2) 

2	1	3	4	5
---	---	---	---	---
- 3) 

5	2	3	4	1
---	---	---	---	---

**Задача 15.31.**

1



- 1) 

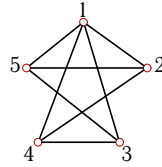
1	2	3	4	5
---	---	---	---	---
- 2) 

2	1	3	4	5
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- 3) 

1	5	3	4	2
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**Задача 15.32.**

1



- 1) 

1	2	3	4	5
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- 2) 

2	1	3	4	5
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- 3) 

5	2	3	4	1
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**Размещение вершин графа на линейке**

	0	1	2	3	min $L$	seq
1	39	36	36	35	11	5 -2 -3 -4 -1
2	44	39	36	33	11	1 -5 -4 -3 -2
3	38	38	38	38	12	2 -1 -3 -4 -5
4	39	38	37	36	12	1 -5 -2 -3 -4
5	33	33	29	24	6	1 -2 -5 -3 -4
6	29	26	25	22	6	2 -5 -4 -1 -3
7	32	29	26	22	6	2 -1 -3 -5 -4
8	35	33	29	25	7	2 -5 -1 -3 -4
9	49	49	47	46	15	1 -5 -2 -4 -3
10	46	43	42	39	12	5 -1 -4 -2 -3
11	51	50	49	46	14	2 -1 -3 -5 -4
12	46	44	43	41	13	2 -1 -3 -5 -4
13	60	60	60	60	20	1 -2 -3 -4 -5
14	40	40	39	38	12	1 -2 -3 -5 -4
15	49	47	46	43	13	1 -5 -4 -2 -3
16	43	43	42	42	14	1 -2 -3 -4 -5
17	36	31	29	27	8	5 -1 -4 -3 -2
18	39	35	34	33	10	5 -1 -4 -3 -2
19	29	29	25	21	7	1 -5 -2 -4 -3
20	46	43	40	38	12	1 -2 -5 -4 -3
21	41	36	33	29	9	1 -5 -4 -2 -3
22	26	26	21	16	4	1 -5 -2 -3 -4
23	37	37	37	34	10	2 -1 -3 -5 -4
24	38	36	32	28	8	2 -5 -1 -3 -4
25	49	47	43	41	13	5 -1 -2 -3 -4
26	31	31	27	23	7	2 -1 -5 -4 -3
27	30	29	27	24	7	2 -1 -3 -5 -4
28	28	23	20	16	4	5 -1 -4 -2 -3
29	43	40	37	36	11	1 -2 -5 -3 -4
30	29	28	27	27	9	2 -1 -5 -4 -3
31	34	33	30	25	7	1 -5 -3 -2 -4
32	51	50	47	44	14	5 -2 -1 -4 -3