

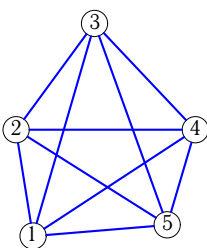
# Муравьиный алгоритм

Найти длину пути муравья в задаче коммивояжера. Начальная вершина 1. Дана последовательность  $P$  случайных чисел, выпавших в при выборе очередной вершины, расстояния  $L_{k,j}$  между вершинами  $k, j$  и интенсивность феромона  $\tau_{k,j}$  на ребре  $[k, j]$ . Секторы вероятности перехода сортировать по возрастанию номеров вершин. Использовать формулу вероятности перехода из вершины  $k$  в  $j$

$$P_{k,j} = 100 \frac{\eta_{k,j}^\alpha \tau_{k,j}^\beta}{\sum \eta_{k,i}^\alpha \tau_{k,i}^\beta}$$

при  $\alpha = 1, \beta = 1, \eta_{k,j} = 1/L_{k,j}$

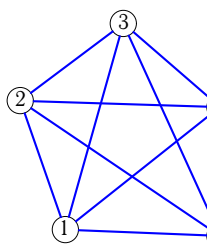
**Задача 12.1.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	40	1
1-3	83	2
1-4	73	1
1-5	51	1
2-3	50	2
2-4	67	1
2-5	67	1
3-4	55	2
3-5	81	2
4-5	37	1

$P = 60, 53, 69.$

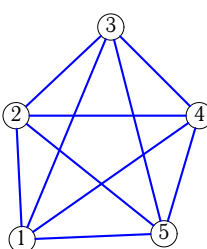
**Задача 12.2.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	51	3
1-3	81	3
1-4	74	2
1-5	58	2
2-3	48	3
2-4	75	2
2-5	91	2
3-4	48	1
3-5	88	1
4-5	48	2

$P = 77, 39, 42.$

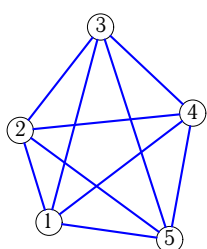
**Задача 12.3.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	47	2
1-3	87	2
1-4	81	2
1-5	53	2
2-3	49	2
2-4	69	2
2-5	71	2
3-4	47	2
3-5	80	2
4-5	46	2

$P = 64, 39, 80.$

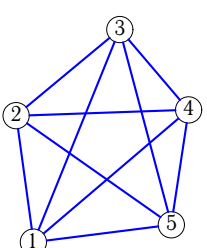
**Задача 12.4.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	36	2
1-3	76	2
1-4	68	2
1-5	46	3
2-3	49	1
2-4	65	1
2-5	70	2
3-4	47	2
3-5	84	3
4-5	48	3

$P = 30, 36, 34.$

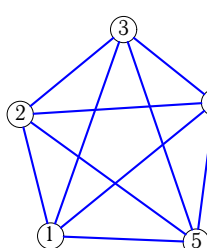
**Задача 12.5.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	48	1
1-3	86	1
1-4	77	2
1-5	52	2
2-3	51	2
2-4	65	3
2-5	71	3
3-4	40	3
3-5	76	3
4-5	44	3

$P = 80, 55, 61.$

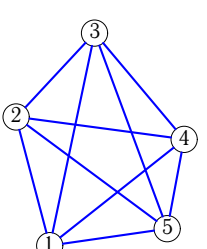
**Задача 12.6.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	47	2
1-3	82	1
1-4	80	1
1-5	55	1
2-3	50	1
2-4	73	1
2-5	82	1
3-4	44	1
3-5	85	1
4-5	53	2

$P = 30, 28, 28.$

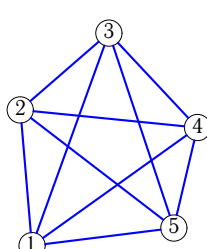
**Задача 12.7.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	50	2
1-3	82	2
1-4	64	1
1-5	45	2
2-3	43	3
2-4	64	2
2-5	71	3
3-4	52	2
3-5	79	3
4-5	34	2

$P = 65, 68, 76.$

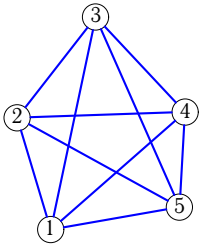
**Задача 12.8.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	51	1
1-3	85	2
1-4	76	1
1-5	54	1
2-3	44	3
2-4	67	2
2-5	73	2
3-4	49	1
3-5	77	1
4-5	39	1

$P = 79, 73, 38.$

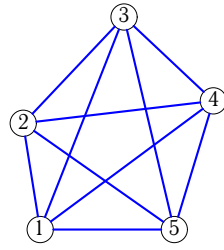
**Задача 12.9.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	44	1
1-3	82	1
1-4	67	2
1-5	49	2
2-3	48	1
2-4	63	2
2-5	70	2
3-4	49	3
3-5	78	3
4-5	36	2

$P = 43, 29, 31.$

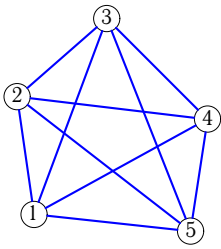
**Задача 12.10.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	40	1
1-3	86	2
1-4	81	2
1-5	51	2
2-3	55	2
2-4	72	2
2-5	70	2
3-4	46	3
3-5	82	3
4-5	51	3

$P = 65, 33, 28.$

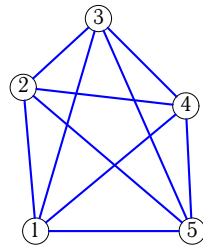
**Задача 12.11.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	45	3
1-3	79	2
1-4	74	2
1-5	59	2
2-3	45	2
2-4	72	2
2-5	83	2
3-4	54	2
3-5	86	2
4-5	43	1

$P = 39, 80, 39.$

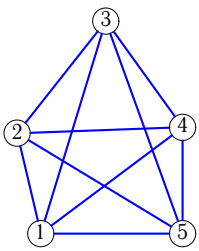
**Задача 12.12.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	54	2
1-3	83	1
1-4	74	2
1-5	59	2
2-3	38	2
2-4	62	3
2-5	83	3
3-4	47	2
3-5	87	2
4-5	47	2

$P = 24, 34, 35.$

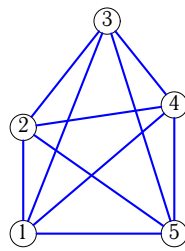
**Задача 12.13.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	39	2
1-3	84	3
1-4	67	3
1-5	53	2
2-3	54	2
2-4	62	2
2-5	73	1
3-4	49	3
3-5	85	2
4-5	40	1

$P = 30, 54, 33.$

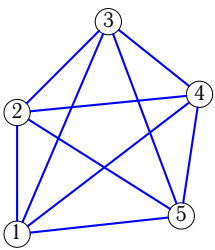
**Задача 12.14.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	40	1
1-3	86	2
1-4	75	2
1-5	57	2
2-3	51	2
2-4	57	2
2-5	70	2
3-4	40	3
3-5	84	3
4-5	48	3

$P = 75, 53, 57.$

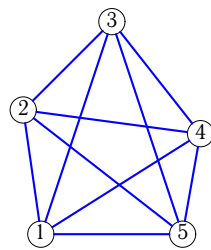
**Задача 12.15.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	46	1
1-3	87	1
1-4	86	1
1-5	62	1
2-3	48	1
2-4	69	1
2-5	73	1
3-4	44	1
3-5	78	1
4-5	46	2

$P = 72, 56, 74.$

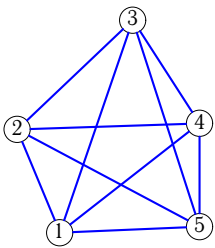
**Задача 12.16.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	47	3
1-3	84	3
1-4	71	2
1-5	53	2
2-3	47	3
2-4	67	2
2-5	76	2
3-4	54	2
3-5	84	2
4-5	38	1

$P = 23, 50, 51.$

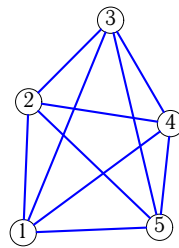
**Задача 12.17.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	42	2
1-3	85	2
1-4	67	3
1-5	53	3
2-3	60	1
2-4	69	2
2-5	78	2
3-4	46	3
3-5	82	3
4-5	39	2

$P = 47, 68, 33.$

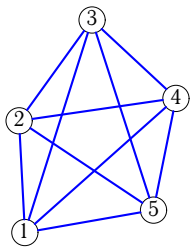
**Задача 12.18.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	49	2
1-3	86	2
1-4	69	1
1-5	51	2
2-3	44	3
2-4	54	2
2-5	68	3
3-4	45	2
3-5	80	3
4-5	39	2

$P = 68, 32, 54.$

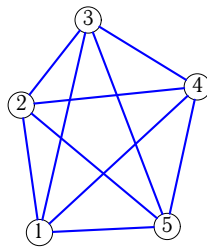
**Задача 12.19.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	42	1
1-3	84	1
1-4	76	2
1-5	49	2
2-3	47	1
2-4	60	2
2-5	61	2
3-4	43	3
3-5	75	3
4-5	43	3

$P = 31, 73, 53.$

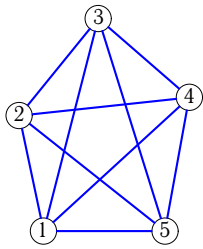
**Задача 12.20.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	48	2
1-3	82	1
1-4	81	2
1-5	48	2
2-3	41	1
2-4	67	2
2-5	71	2
3-4	48	2
3-5	83	2
4-5	54	3

$P = 26, 44, 72.$

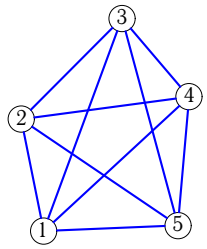
**Задача 12.21.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	44	1
1-3	83	2
1-4	74	1
1-5	46	2
2-3	47	2
2-4	64	1
2-5	70	2
3-4	45	1
3-5	84	2
4-5	51	3

$P = 53, 73, 22.$

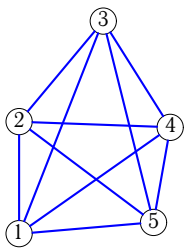
**Задача 12.22.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	43	1
1-3	85	1
1-4	74	2
1-5	51	2
2-3	54	1
2-4	64	2
2-5	71	2
3-4	39	3
3-5	81	3
4-5	49	3

$P = 71, 36, 22.$

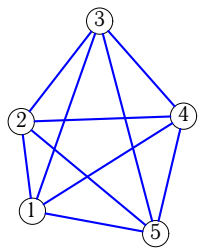
**Задача 12.23.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	42	2
1-3	86	2
1-4	70	1
1-5	51	1
2-3	49	2
2-4	57	1
2-5	63	1
3-4	47	2
3-5	78	2
4-5	36	1

$P = 22, 34, 54.$

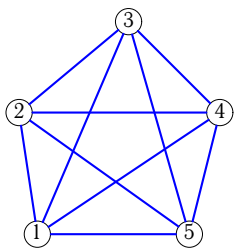
**Задача 12.24.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	34	2
1-3	76	2
1-4	67	3
1-5	47	2
2-3	48	1
2-4	61	2
2-5	66	1
3-4	48	3
3-5	83	2
4-5	45	1

$P = 63, 63, 68.$

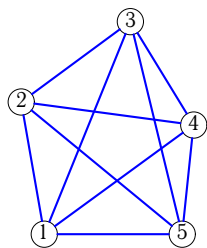
**Задача 12.25.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	46	2
1-3	87	2
1-4	82	2
1-5	57	2
2-3	54	2
2-4	75	2
2-5	79	2
3-4	48	2
3-5	83	2
4-5	47	2

$P = 30, 50, 72.$

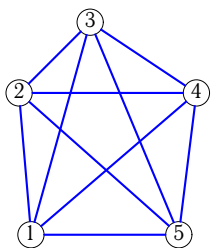
**Задача 12.26.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	50	2
1-3	86	1
1-4	70	1
1-5	52	2
2-3	51	2
2-4	65	2
2-5	78	3
3-4	46	2
3-5	82	3
4-5	41	2

$P = 35, 59, 74.$

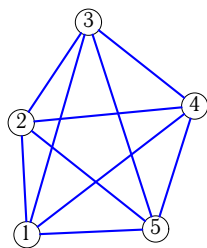
**Задача 12.27.**



Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	54	2
1-3	83	2
1-4	82	2
1-5	56	1
2-3	38	3
2-4	67	3
2-5	80	2
3-4	48	2
3-5	87	1
4-5	54	2

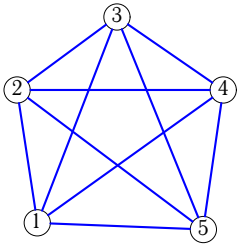
$P = 31, 72, 41.$

**Задача 12.28.**



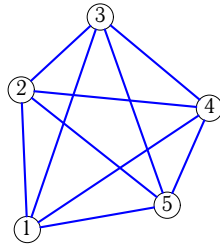
Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	42	1
1-3	83	1
1-4	80	1
1-5	48	2
2-3	46	1
2-4	66	1
2-5	64	2
3-4	51	2
3-5	82	3
4-5	49	3

$P = 46, 63, 80.$

**Задача 12.29.**

Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	51	3
1-3	83	2
1-4	86	3
1-5	63	2
2-3	47	2
2-4	78	3
2-5	88	2
3-4	49	2
3-5	86	1
4-5	53	2

$P = 66, 44, 42.$

**Задача 12.30.**

Ребро	$L_{k,j}$	$\tau_{k,j}$
1-2	53	1
1-3	85	1
1-4	82	1
1-5	53	2
2-3	40	2
2-4	71	2
2-5	70	3
3-4	54	1
3-5	75	2
4-5	40	2

$P = 34, 30, 32.$

**Муравьиный алгоритм**

№	Путь	Расстояние
1	1-4-3-5-2-1	316
2	1-4-3-2-5-1	319
3	1-4-3-5-2-1	326
4	1-2-4-3-5-1	278
5	1-5-4-3-2-1	235
6	1-2-3-4-5-1	249
7	1-5-4-3-2-1	224
8	1-5-4-2-3-1	289
9	1-4-3-2-5-1	283
10	1-4-3-2-5-1	303
11	1-2-5-3-4-1	342
12	1-2-3-4-5-1	245
13	1-2-4-3-5-1	288
14	1-5-4-3-2-1	236
15	1-4-5-3-2-1	304
16	1-2-3-4-5-1	239
17	1-4-5-2-3-1	329
18	1-5-2-3-4-1	277
19	1-3-5-4-2-1	304
20	1-2-4-5-3-1	334
21	1-4-5-2-3-1	325
22	1-5-3-4-2-1	278
23	1-2-3-4-5-1	225
24	1-4-3-5-2-1	298
25	1-2-4-5-3-1	338
26	1-2-4-5-3-1	324
27	1-2-4-3-5-1	312
28	1-4-5-3-2-1	299
29	1-4-3-2-5-1	333
30	1-3-2-4-5-1	289