Университет ИТМО

Факультет программной инженерии и компьютерной техники

Кафедра вычислительной техники

Домашняя работа № 2 по дисциплине ”Конструкторско-техническое обеспечение производства ЭВМ”

Вариант 18

Выполнил:

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Исходные данные

Матрица комплексов Q в траспонированном виде

	e_1	e_2	e_3	e_4	e_5	e_6	e_7	e_8	e_9	e_{10}	e_{11}	e_{12}	e_{13}	e_{14}	e_{15}	e_{16}	e_{17}
u_1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1
u_2	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0
u_3	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1
u_4	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1
u_5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1
u_6	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0
u_7	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	1
u_8	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
u_9	0	0	1	0	0	0	0	0	1	0	0	1	0	0	1	1	0
u_{10}	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1
u_{11}	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1
u_{12}	0	1	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0
u_{13}	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	0	1
u_{14}	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1
u_{15}	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1
u_{16}	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0
u_{17}	0	0	1	0	0	0	0	1	0	0	1	0	0	1	1	0	0
u_{18}	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0
u_{19}	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0
u_{20}	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	0
u_{21}	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0
u_{22}	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0
u_{23}	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0
u_{24}	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0
u_{25}	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0
u_{26}	0	0	0	0	0	0	0	1	1	1	0	0	1	0	0	0	0
u_{27}	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0
u_{28}	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0
u_{29}	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
u_{30}	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0

Матрица смежности R

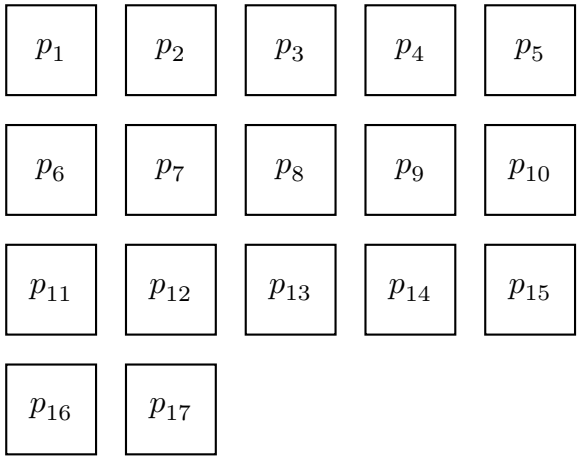
	e_1	e_2	e_3	e_4	e_5	e_6	e_7	e_8	e_9	e_{10}	e_{11}	e_{12}	e_{13}	e_{14}	e_{15}	e_{16}	e_{17}
e_1	0	2	0	2	1	1	2	0	2	2	0	0	2	4	2	3	1
e_2	2	0	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1
e_3	0	1	0	0	0	1	0	3	2	2	1	1	1	1	3	2	1
e_4	2	0	0	0	1	1	1	0	0	0	0	0	2	3	1	2	4

	e_1	e_2	e_3	e_4	e_5	e_6	e_7	e_8	e_9	e_{10}	e_{11}	e_{12}	e_{13}	e_{14}	e_{15}	e_{16}	e_{17}
e_5	1	1	0	1	0	0	1	0	0	1	1	2	3	1	1	2	2
e_6	1	0	1	1	0	0	1	1	0	2	0	0	1	0	1	2	3
e_7	2	0	0	1	1	1	0	1	1	1	1	1	0	1	0	1	1
e_8	0	1	3	0	0	1	1	0	2	2	3	1	2	3	1	3	2
e_9	2	1	2	0	0	0	1	2	0	2	0	2	4	2	2	3	0
e_{10}	2	1	2	0	1	2	1	2	2	0	0	0	2	0	4	0	3
e_{11}	0	1	1	0	1	0	1	3	0	0	0	2	1	2	1	1	0
e_{12}	0	1	1	0	2	0	1	1	2	0	2	0	3	0	2	3	0
e_{13}	2	1	1	2	3	1	0	2	4	2	1	3	0	2	1	3	1
e_{14}	4	1	1	3	1	0	1	3	2	0	2	0	2	0	3	3	3
e_{15}	2	1	3	1	1	1	0	1	2	4	1	2	1	3	0	4	4
e_{16}	3	1	2	2	2	2	1	3	3	0	1	3	3	3	4	0	3
e_{17}	1	1	1	4	2	3	1	2	0	3	0	0	1	3	4	3	0

Выполнение

Метод обратного размещения

Зададим поверхность:



Матрица D расстояний между позициями для размещения.

	p_1	p_2	p_3	p_4	p_5	p_6	p_7	p_8	p_9	p_{10}	p_{11}	p_{12}	p_{13}	p_{14}	p_{15}	p_{16}	p_{17}
p_1	0	1	2	3	4	1	2	3	4	5	2	3	4	5	6	3	4
p_2	1	0	1	2	3	2	1	2	3	4	3	2	3	4	5	4	3
p_3	2	1	0	1	2	3	2	1	2	3	4	3	2	3	4	5	4
p_4	3	2	1	0	1	4	3	2	1	2	5	4	3	2	3	6	5
p_5	4	3	2	1	0	5	4	3	2	1	6	5	4	3	2	7	6
p_6	1	2	3	4	5	0	1	2	3	4	1	2	3	4	5	2	3
p_7	2	1	2	3	4	1	0	1	2	3	2	1	2	3	4	3	2
p_8	3	2	1	2	3	2	1	0	1	2	3	2	1	2	3	4	3

	p_1	p_2	p_3	p_4	p_5	p_6	p_7	p_8	p_9	p_{10}	p_{11}	p_{12}	p_{13}	p_{14}	p_{15}	p_{16}	p_{17}
p_9	4	3	2	1	2	3	2	1	0	1	4	3	2	1	2	5	4
p_{10}	5	4	3	2	1	4	3	2	1	0	5	4	3	2	1	6	5
p_{11}	2	3	4	5	6	1	2	3	4	5	0	1	2	3	4	1	2
p_{12}	3	2	3	4	5	2	1	2	3	4	1	0	1	2	3	2	1
p_{13}	4	3	2	3	4	3	2	1	2	3	2	1	0	1	2	3	2
p_{14}	5	4	3	2	3	4	3	2	1	2	3	2	1	0	1	4	3
p_{15}	6	5	4	3	2	5	4	3	2	1	4	3	2	1	0	5	4
p_{16}	3	4	5	6	7	2	3	4	5	6	1	2	3	4	5	0	1
p_{17}	4	3	4	5	6	3	2	3	4	5	2	1	2	3	4	1	0

Упорядочим позиции p_i в порядке невозрастания d_i:

p_{16}	p_5	p_{15}	p_1	p_{17}	p_{10}	p_{11}	p_4	p_6	p_2	p_{14}	p_3	p_9	p_{12}	p_{13}	p_7	p_8
61	58	54	52	52	51	48	47	45	43	43	42	40	39	38	36	35

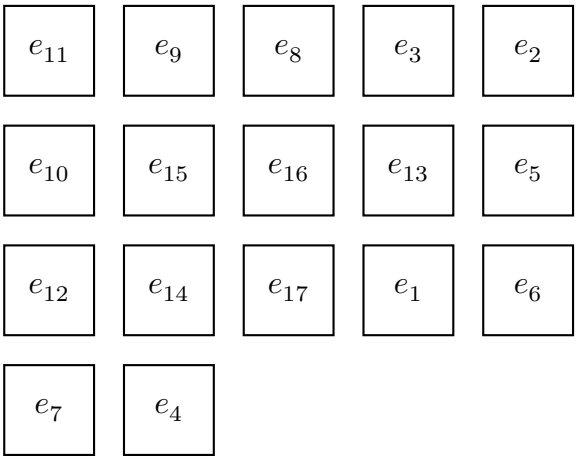
Упорядочим элементы e_i в порядке неубывания r_i:

e_7	e_2	e_6	e_{11}	e_4	e_5	e_{12}	e_3	e_{10}	e_9	e_1	e_8	e_{13}	e_{14}	e_{17}	e_{15}	e_{16}
13	14	14	14	17	17	18	19	22	23	24	25	29	29	29	31	36

Соотнесем списки D_i и R_i:

61	58	54	52	52	51	48	47	45	43	43	42	40	39	38	36	35
p_{16}	p_5	p_{15}	p_1	p_{17}	p_{10}	p_{11}	p_4	p_6	p_2	p_{14}	p_3	p_9	p_{12}	p_{13}	p_7	p_8
e_7	e_2	e_6	e_{11}	e_4	e_5	e_{12}	e_3	e_{10}	e_9	e_1	e_8	e_{13}	e_{14}	e_{17}	e_{15}	e_{16}
13	14	14	14	17	17	18	19	22	23	24	25	29	29	29	31	36

Разместим элементы в соответствии с упорядоченными списками:



Раскраска графа алгоритмом упорядоченных вершин

Подсчитаем число ненулевых элементов в каждом ряду матрицы соединений

e_1	e_2	e_3	e_4	e_5	e_6	e_7	e_8	e_9	e_{10}	e_{11}	e_{12}	e_{13}	e_{14}	e_{15}	e_{16}	e_{17}
12	13	12	9	12	10	12	13	11	11	10	10	15	13	15	15	13

C=1

e_{13}	e_{15}	e_{16}	e_2	e_8	e_{14}	e_{17}	e_1	e_3	e_5	e_7	e_9	e_{10}	e_6	e_{11}	e_{12}	e_4
15	15	15	13	13	13	13	12	12	12	12	11	11	10	10	10	9
1										1						

C=2

e_{15}	e_{16}	e_2	e_8	e_{14}	e_{17}	e_1	e_3	e_5	e_9	e_{10}	e_6	e_{11}	e_{12}	e_4
15	15	13	13	13	13	12	12	12	11	11	10	10	10	9
2														

C=3

e_{16}	e_2	e_8	e_{14}	e_{17}	e_1	e_3	e_5	e_9	e_{10}	e_6	e_{11}	e_{12}	e_4
15	13	13	13	13	12	12	12	11	11	10	10	10	9
3									3				

C=4

e_2	e_8	e_{14}	e_{17}	e_1	e_3	e_5	e_9	e_6	e_{11}	e_{12}	e_4
13	13	13	13	12	12	12	11	10	10	10	9
4											4

C=5

e_8	e_{14}	e_{17}	e_1	e_3	e_5	e_9	e_6	e_{11}	e_{12}
13	13	13	12	12	12	11	10	10	10
5			5						

C=6

e_{14}	e_{17}	e_3	e_5	e_9	e_6	e_{11}	e_{12}
13 6	13	12	12	11	10 6	10	10 6

C=7

e_{17}	e_3	e_5	e_9	e_{11}
13 7	12	12	11 7	10 7

C=8

e_3	e_5
12 8	12 8

Результирующая матрица весов C, определяемая по формуле $C_{i,j} = R_{i,j} \cdot D_{i,j}$:

	c_1	c_2	c_3	c_4	c_5	c_6	c_7	c_8	c_9	c_{10}	c_{11}	c_{12}	c_{13}	c_{14}	c_{15}	c_{16}	c_{17}
c_1	0	2	0	6	4	1	4	0	8	10	0	0	8	20	12	9	4
c_2	2	0	1	0	3	0	0	2	3	4	3	2	3	4	5	4	3
c_3	0	1	0	0	0	3	0	3	4	6	4	3	2	3	12	10	4
c_4	6	0	0	0	1	4	3	0	0	0	0	0	6	6	3	12	20
c_5	4	3	0	1	0	0	4	0	0	1	6	10	12	3	2	14	12
c_6	1	0	3	4	0	0	1	2	0	8	0	0	3	0	5	4	9
c_7	4	0	0	3	4	1	0	1	2	3	2	1	0	3	0	3	2
c_8	0	2	3	0	0	2	1	0	2	4	9	2	2	6	3	12	6
c_9	8	3	4	0	0	0	2	2	0	2	0	6	8	2	4	15	0
c_{10}	10	4	6	0	1	8	3	4	2	0	0	0	6	0	4	0	15
c_{11}	0	3	4	0	6	0	2	9	0	0	0	2	2	6	4	1	0
c_{12}	0	2	3	0	10	0	1	2	6	0	2	0	3	0	6	6	0
c_{13}	8	3	2	6	12	3	0	2	8	6	2	3	0	2	2	9	2
c_{14}	20	4	3	6	3	0	3	6	2	0	6	0	2	0	3	12	9
c_{15}	12	5	12	3	2	5	0	3	4	4	4	6	2	3	0	20	16
c_{16}	9	4	10	12	14	4	3	12	15	0	1	6	9	12	20	0	3
c_{17}	4	3	4	20	12	9	2	6	0	15	0	0	2	9	16	3	0

Поиск кратчайших путей

Пошаговое выполнение алгоритма Дейкстры:

1.

$$min[l(x_i)] = l(x_1) = 0$$

$\Gamma_p = \{x_2, x_4, x_5, x_6, x_7, x_9, x_{10}, x_{13}, x_{14}, x_{15}, x_{16}, x_{17}\}$

$$l(x_2) = min[\infty, 0 + 2] = 2$$
$$l(x_4) = min[\infty, 0 + 6] = 6$$
$$l(x_5) = min[\infty, 0 + 4] = 4$$
$$l(x_6) = min[\infty, 0 + 1] = 1$$
$$l(x_7) = min[\infty, 0 + 4] = 4$$
$$l(x_9) = min[\infty, 0 + 8] = 8$$
$$l(x_{10}) = min[\infty, 0 + 10] = 10$$
$$l(x_{13}) = min[\infty, 0 + 8] = 8$$
$$l(x_{14}) = min[\infty, 0 + 20] = 20$$
$$l(x_{15}) = min[\infty, 0 + 12] = 12$$
$$l(x_{16}) = min[\infty, 0 + 9] = 9$$
$$l(x_{17}) = min[\infty, 0 + 4] = 4$$

$$min[l(x_i)] = l(x_6) = 1$$

2.

$\Gamma_p = \{x_3, x_4, x_7, x_8, x_{10}, x_{13}, x_{15}, x_{16}\}$

$$l(x_3) = min[\infty, 1 + 3] = 4$$
$$l(x_4) = min[6, 1 + 4] = 5$$
$$l(x_7) = min[4, 1 + 1] = 2$$
$$l(x_8) = min[\infty, 1 + 2] = 3$$
$$l(x_{10}) = min[10, 1 + 8] = 9$$
$$l(x_{13}) = min[8, 1 + 3] = 4$$
$$l(x_{15}) = min[12, 1 + 5] = 6$$
$$l(x_{16}) = min[9, 1 + 4] = 5$$

$$min[l(xi)] = l(x_2) = 2$$

3.

$\Gamma_p = \{x_3, x_9, x_{10}, x_{11}, x_{12}, x_{14}\}$

$$l(x_3) = min[4, 2+1] = 3$$
$$l(x_9) = min[8, 2+3] = 5$$
$$l(x_{10}) = min[9, 2+4] = 6$$
$$l(x_{11}) = min[\infty, 2+3] = 5$$
$$l(x_{12}) = min[\infty, 2+2] = 4$$
$$l(x_{14}) = min[20, 2+4] = 6$$

$$min[l(xi)] = l(x_7) = 2$$

4.

$\Gamma_p = \{x_9, x_{10}, x_{11}, x_{12}, x_{14}\}$

$$l(x_9) = min[5, 2+2] = 4$$
$$l(x_{10}) = min[6, 2+3] = 5$$
$$l(x_{11}) = min[5, 2+2] = 4$$
$$l(x_{12}) = min[4, 2+1] = 3$$
$$l(x_{14}) = min[6, 2+3] = 5$$

$$min[l(x_i)] = l(x_3) = 3$$
$$min[l(x_i)] = l(x_8) = 3$$
$$min[l(x_i)] = l(x_{12}) = 3$$
$$min[l(x_i)] = l(x_5) = 4$$
$$min[l(x_i)] = l(x_9) = 4$$
$$min[l(x_i)] = l(x_{11}) = 4$$
$$min[l(x_i)] = l(x_{13}) = 4$$
$$min[l(x_i)] = l(x_{17}) = 4$$
$$min[l(x_i)] = l(x_4) = 5$$
$$min[l(x_i)] = l(x_{10}) = 5$$
$$min[l(x_i)] = l(x_{14}) = 5$$
$$min[l(x_i)] = l(x_{16}) = 5$$
$$min[l(x_i)] = l(x_{15}) = 6$$

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
e_1	[0]																
e_2	∞	2	[2]														
e_3	∞	∞	4	3	[3]												
e_4	∞	6	5	5	5	5	5	5	5	5	5	5	[5]				
e_5	∞	4	4	4	4	4	4	[4]									
e_6	∞	[1]															
e_7	∞	4	2	[2]													
e_8	∞	∞	3	3	3	[3]											
e_9	∞	8	8	5	4	4	4	4	[4]								
e_{10}	∞	10	9	6	5	5	5	5	5	5	5	5	5	[5]			
e_{11}	∞	∞	∞	5	4	4	4	4	4	[4]							
e_{12}	∞	∞	∞	4	3	3	[3]										
e_{13}	∞	8	4	4	4	4	4	4	4	4	[4]						
e_{14}	∞	20	20	6	5	5	5	5	5	5	5	5	5	5	[5]		
e_{15}	∞	12	6	6	6	6	6	6	6	6	6	6	6	6	6	6	[6]
e_{16}	∞	9	5	5	5	5	5	5	5	5	5	5	5	5	5	[5]	
e_{17}	∞	4	4	4	4	4	4	4	4	4	4	[4]					

Поиск пропускной способности алгоритмом Франка-Фриша

Расчёт пропускной способности от e_1 до e_4

MAX Q = 20

	$e_{1,14}$	e_2	e_3	$e_{4,17}$	e_5	e_6	e_7	e_8	e_9	e_{10}	e_{11}	e_{12}	e_{13}	$e_{15,16}$
$e_{1,14}$	0	4	3	9	4	1	4	6	8	10	6	0	8	12
e_2	4	0	1	3	3	0	0	2	3	4	3	2	3	5
e_3	3	1	0	4	0	3	0	3	4	6	4	3	2	12
$e_{4,17}$	9	3	4	0	12	9	3	6	0	15	0	0	6	16
e_5	4	3	0	12	0	0	4	0	0	1	6	10	12	14
e_6	1	0	3	9	0	0	1	2	0	8	0	0	3	5
e_7	4	0	0	3	4	1	0	1	2	3	2	1	0	3
e_8	6	2	3	6	0	2	1	0	2	4	9	2	2	12
e_9	8	3	4	0	0	0	2	2	0	2	0	6	8	15
e_{10}	10	4	6	15	1	8	3	4	2	0	0	0	6	4
e_{11}	6	3	4	0	6	0	2	9	0	0	0	2	2	4
e_{12}	0	2	3	0	10	0	1	2	6	0	2	0	3	6
e_{13}	8	3	2	6	12	3	0	2	8	6	2	3	0	9
$e_{15,16}$	12	5	12	16	14	5	3	12	15	4	4	6	9	0

MAX Q = 12

	$e_{1,14,3,4,17,5,8,9,10,13,15,16}$	e_2	e_6	e_7	e_{11}	e_{12}
$e_{1,14,3,4,17,5,8,9,10,13,15,16}$	0	5	9	4	9	10
e_2	5	0	0	0	3	2
e_6	9	0	0	1	0	0
e_7	4	0	1	0	2	1
e_{11}	9	3	0	2	0	2
e_{12}	10	2	0	1	2	0

Пропускная способность равна 12

Путь от e_1 до e_4