Благодарина Артём 3 курс 3 группа

Таблица а: $3(8+8) \bmod 30 + 1 = 19$

Таблица б: $3(8+9) \bmod 30 + 1 = 22$

	v_1	v_2	v_3	v_4	v_5	
u_1	3 (6)	5 (3)	11	8	10	9 (3)
u_2	8	7 (-)	1 (+)	4	3	8 (4)
u_3	10	11 (+)	12 (5)	9 (3)	7	8 (3)
u_4	6	4	7	8 (5)	10 (7)	12 (7)
	(6)	7 (1)	9 (5)	8 (5)	7	

1. Условие баланса

$9+8+8+12 = 6+7+9+8+7$

$37 = 37$ Выполнено

2. Опорный план найдём с помощью метода северо-западного угла

3 $S = 3 \cdot 6 + 5 \cdot 3 + 7 \cdot 4 + 1 \cdot 4 + 12 \cdot 5 + 9 \cdot 3 + 8 \cdot 5 + 10 \cdot 7 = 262$

Проверяем на не вырожденность:

$N = m + n - 1 = 4 + 5 - 1 = 8$ Выполнено!

Вычисление потенциалов:

$-C_{ij} = u_i + v_j$

$u_1 + v_1 = -3$
$u_1 + v_2 = -5$
$u_2 + v_2 = -7$
$u_2 + v_3 = -1$
$u_3 + v_3 = -12$
$u_3 + v_4 = -9$
$u_4 + v_4 = -8$
$u_4 + v_5 = -10$

$u_1 = 0$
$u_2 = -2$
$u_3 = -13$
$u_4 = -12$

$v_1 = -3$
$v_2 = -5$
$v_3 = 1$
$v_4 = 4$
$v_5 = 2$

Оценки небазисных: $\delta_{ij} = -C_{ij} - (u_i + v_j)$

$u_1 v_3 = -11 - (0+1) = -12$ +
$u_1 v_4 = -8 - (0+4) = -12$ +
$u_1 v_5 = -10 - (0+2) = -12$ +
$u_2 v_1 = -8 - (-2-3) = -3$ +
$u_2 v_4 = -4 - (-2+4) = -6$ +
$u_2 v_5 = -3 - (-2+2) = -3$ +
$u_3 v_1 = -10 - (-13-3) = 6$ −
$u_3 v_2 = -4 - (-13-5) = 14$ −
$u_3 v_5 = -7 - (-13+2) = 4$ −
$u_4 v_1 = -6 - (-12-3) = 9$ −
$u_4 v_2 = -4 - (-12-5) = 13$ −
$u_4 v_3 = -7 - (-12+1) = 4$ −

Нарушение по $u_3 v_2$ max:

Цикл: $(3,2) \to (2,2) \to (2,3) \to (3,3) \to (3,2)$

min = 4 у $u_2 v_2$

	v_1	v_2	v_3	v_4	v_5	
u_1	3 (6)	5 (3)	11	8	10	9
u_2	8	7	1 (8)	4	3	8
u_3	10	11 − [4]	12	9 + [1]	7 [3]	8
u_4	6	4 + [ ]	7	8 − [5]	10 [7]	12
	6	7	9	8	7	

Потенциалы:

$u_1 + v_1 = -3$ $u_3 + v_3 = -12$
$u_1 + v_2 = -5$ $u_3 + v_4 = -9$
$u_2 + v_3 = -1$ $u_4 + v_4 = -8$
$u_3 + v_2 = -11$ $u_4 + v_5 = -10$

$u_1 = 0$ $v_1 = -3$
$u_2 = 5$ $v_2 = -5$
$u_3 = -6$ $v_3 = -6$
$u_4 = -5$ $v_4 = -3$
$v_5 = -5$

$u_1 v_3 = -11 - (0-6) = -5$ +
$u_1 v_4 = -8 - (0-3) = -5$ +
$u_1 v_5 = -10 - (0-5) = -5$ +
$u_2 v_1 = -8 - (5-3) = -16$ +
$u_2 v_2 = -7 - (5-5) = -7$ +
$u_2 v_4 = -4 - (5-3) = -6$ +
$u_2 v_5 = -3 - (5-5) = 0$ +
$u_3 v_1 = -10 - (-6-3) = -1$ +
$u_3 v_5 = -7 - (-6-5) = 4$ −
$u_4 v_1 = -6 - (-5-3) = 2$ −
$u_4 v_2 = -4 - (-5-5) = 6$ −
$u_4 v_3 = -7 - (-5-6) = 4$ −

Нарушение по $u_4 v_2$ max:

min 4 у u_3v_2

Цикл: $u_4v_2 \to u_3v_2 \to u_3v_4 \to u_4v_5 \to u_4v_2$

	v_1	v_2	v_3	v_4	v_5	
u_1	3 (6)	5 (3)	11	8	10	9
u_2	8	7	1 (8)	4	3	8
u_3	10	11	12 (1)	9 (−) 7	7 (+)	8
u_4	6	4 (4)	7	+8 1	10 (−) 7	12
	6	7	9	8	7	

$u_1+v_1=-3$
$u_1+v_2=-5$
$u_2+v_3=-1$
$u_3+v_3=-12$
$u_3+v_4=-9$
$u_4+v_2=-4$
$u_4+v_4=-8$
$u_4+v_5=-10$

$u_1=0$
$u_2=11$
$u_3=0$
$u_4=1$

$v_1=-3$
$v_2=-5$
$v_3=-12$
$v_4=-9$
$v_5=-11$

$u_1v_3=-1-(0-12)=1$ −
$u_1v_4=-8-(0-9)=1$ −
$u_1v_5=-10-(0-11)=1$ −
$u_2v_1=-8-(11-3)=-16$ +
$u_2v_2=-7-(11-5)=-13$ +
$u_2v_4=-4-(11-9)=-6$ +
$u_2v_5=-3-(11-11)=-3$ +
$u_3v_1=-10-(0-3)=-7$ +
$u_3v_2=-11-(0-5)=-6$ +
$u_3v_5=-7-(0-11)=4$ −
$u_4v_1=-6-(1-3)=-8$ +
$u_4v_3=-7-(1-12)=4$ −

Нарушение по u_3v_5

min 7

	v_1	v_2	v_3	v_4	v_5	
u_1	3 (6)	5 (3)	11	8	10	9
u_2	8	7	1 (8)	4	3	8
u_3	10	11	12 (1)	9 (0)	7 (7)	8
u_4	6	4 (4)	7	8 (8)	10	12
	6	7	9	8	7	

$u_1+v_1=-3$
$u_1+v_2=-5$
$u_2+v_3=-1$
$u_3+v_3=-12$
$u_3+v_5=-7$
$u_4+v_2=-4$
$u_4+v_4=-8$
$u_3+v_4=-9$

$u_1=0$
$u_2=11$
$u_3=0$
$u_4=1$

$v_1=-3$
$v_2=-5$
$v_3=-12$
$v_4=-9$
$v_5=-7$

$u_1v_3=-1-(0-12)=1$ −
$u_1v_4=-8-(0-9)=1$ −
$u_1v_5=-10-(0-7)=-3$ +
$u_2v_1=-8-(11-3)=-16$ +
$u_2v_2=-7-(11-5)=-13$ +
$u_2v_4=-4-(11-9)=-6$ +
$u_2v_5=-3-(11-7)=-7$ +
$u_3v_1=-10-(0-3)=-7$ +
$u_3v_2=-11-(0-5)=-6$ +
$u_4v_1=-6-(1-3)=-4$ +
$u_4v_3=-7-(1-12)=4$ −
$u_4v_5=-10-(1-7)=-4$ +

Нарушение по $u_4 v_3$ min = 1

	v_1	v_2	v_3	v_4	v_5
u_1	3 (6)	5 (−3)	11	8	10 (+)
u_2	8	7	1 (8)	4	3
u_3	10	4	12	9 (1)	7 (7)
u_4	6 (+4)	4	7 (1)	8 (7)	10

$u_1 + v_1 = -3$ $u_1 = 0$ $v_1 = -3$
$u_1 + v_2 = -5$ $u_2 = 7$ $v_2 = -5$
$u_2 + v_3 = -1$ $u_3 = 0$ $v_3 = -8$
$u_3 + v_4 = -9$ $u_4 = 1$ $v_4 = -9$
$u_3 + v_5 = -7$ $v_5 = -7$
$u_4 + v_2 = -4$
$u_4 + v_3 = -7$
$u_4 + v_4 = -8$

$u_1 v_3 = -11 - (0 - 8) = -3$ +
$u_1 v_4 = -8 - (0 - 9) = 1$ −
$u_1 v_5 = -10 - (0 - 7) = -3$ +
$u_2 v_1 = -8 - (7 - 3) = -12$ +
$u_2 v_2 = -7 - (7 - 5) = -9$ +
$u_2 v_4 = -4 - (7 - 9) = -2$ +

$u_2 v_5 = -3 - (7 - 7) = -3$ +
$u_3 v_1 = -10 - (0 - 3) = -13$ +
$u_3 v_2 = -4 - (0 - 5) = -6$ +
$u_3 v_3 = -12 - (0 - 8) = -3$ +
$u_4 v_1 = -6 - (1 - 3) = -4$ +
$u_4 v_5 = -10 - (1 - 7) = -3$ +

Нарушение по $u_1 v_4$ min = 3

9	3 (6)	5	11	8 (3)	10
8	8	7	1 (8)	4	3
8	10	4	12	9 (1)	7 (7)
12	6 (7)	4 (7)	7 (1)	8 (4)	10

6 7 9 8 7

$u_1 + v_1 = -3$ $u_1 = 0$ $v_1 = -3$
$u_1 + v_4 = -8$ $u_2 = 6$ $v_2 = -4$
$u_2 + v_3 = -1$ $u_3 = -1$ $v_3 = -7$
$u_3 + v_4 = -9$ $u_4 = 0$ $v_4 = -8$
$u_3 + v_5 = -7$ $v_5 = -6$
$u_4 + v_2 = -4$
$u_4 + v_3 = -7$
$u_4 + v_4 = -8$

$u_1 v_2 = -5 - (6 - 4) = -1$ +
$u_1 v_3 = -11 - (0 - 7) = -4$ +
$u_1 v_5 = -10 - (0 - 6) = -4$ +
$u_2 v_1 = -8 - (6 - 3) = -11$ +
$u_2 v_2 = -7 - (6 - 4) = -9$ +
$u_2 v_4 = -4 - (6 - 8) = -2$ +

$u_2 v_5 = -3 - (6 - 6) = -3$ +
$u_3 v_1 = -10 - (-1 - 3) = -6$ +
$u_3 v_2 = -11 - (-1 - 4) = -6$ +
$u_3 v_3 = -12 - (-1 - 7) = -4$ +
$u_4 v_1 = -6 - (0 - 3) = -9$ +
$u_4 v_5 = -10 - (0 - 6) = -4$ +

План оптимален.