Университет ИТМО

Кафедра ВТ

Конструкционно-технологическое обеспечение производства ЭВМ

Домашняя работа №3

«Графо-теоретический подход к синтезу топологии»

Вариант №33

Выполнил: Фролов Сергей

Гр. Р3415

2017

**Исходные данные**

Цепей: 20 Модулей 11

1. 8/4, 6/14, 7/11
2. 10/2, 4/6, 9/4
3. 9/8, 11/10, 6/6, 1/3
4. 5/8, 8/13, 10/9, 9/7
5. 5/6, 9/10, 2/8, 4/1
6. 7/3, 6/5, 11/7, 7/1
7. 3/3, 6/9, 10/8, 10/1
8. 2/2, 8/11, 4/11, 9/11
9. 10/10, 11/6, 11/4, 11/1
10. 11/11, 9/3, 6/4
11. 10/14, 7/10, 4/5
12. 9/13, 10/13, 10/3, 10/6
13. 9/5, 10/4, 3/12, 6/1
14. 2/10, 9/9, 3/11, 11/12
15. 7/12, 11/14, 1/8, 11/13
16. 3/5, 10/12, 7/4
17. 11/3, 7/13, 9/12, 4/13
18. 3/14, 11/8, 4/9, 9/6
19. 6/8, 11/5, 11/9, 7/5
20. 11/2, 10/11, 2/6, 9/2

**Матрица комплексов**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | u1 | u2 | u3 | u4 | u5 | u6 | u7 | u8 | u9 | u10 | u11 | u12 | u13 | u14 | u15 | u16 | u17 | u18 | u19 | u20 |
| e1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| e2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| e3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| e4 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| e5 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| e6 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| e7 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| e8 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| e9 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| e10 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| e11 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |

**Матрица соединений**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | e1 | e2 | e3 | e4 | e5 | e6 | e7 | e8 | e9 | e10 | e11 |
| e1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 2 |
| e2 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 1 | 4 | 1 | 2 |
| e3 | 0 | 1 | 0 | 1 | 0 | 2 | 1 | 0 | 3 | 3 | 2 |
| e4 | 0 | 2 | 1 | 0 | 1 | 0 | 2 | 1 | 5 | 2 | 2 |
| e5 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 1 | 0 |
| e6 | 1 | 0 | 2 | 0 | 0 | 0 | 3 | 1 | 3 | 2 | 4 |
| e7 | 1 | 0 | 1 | 2 | 0 | 3 | 0 | 1 | 1 | 2 | 4 |
| e8 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 2 | 1 | 0 |
| e9 | 1 | 4 | 3 | 5 | 2 | 3 | 1 | 2 | 0 | 5 | 6 |
| e10 | 0 | 1 | 3 | 2 | 1 | 2 | 2 | 1 | 5 | 0 | 2 |
| e11 | 2 | 2 | 2 | 2 | 0 | 4 | 4 | 0 | 6 | 2 | 0 |

1. **Нахождение гамильтонова цикла**

Алгоритм:

1. Задаем n=1
2. Вычеркиваем из матрицы строку еn
3. Находим верхнюю ячейку в столбце еn из имеющих положительное значение
4. Если такой нет, выполнение завершается. Если такая есть, то определяем, какой вершине еm соответствует эта ячейка; устанавливаем n=m; повторяем с п. 2.

Начальные шаги:

1. n=1
2. Вычеркиваем из матрицы строку е1
3. Обнаруживаем, что есть вершина с е6
4. n=6
5. Вычеркиваем из матрицы строку е6
6. Обнаруживаем, что есть вершина у е6 и е3
7. n=3

и т. д.

В результате имеется путь:

Перенумерация вершин

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Новые | e1 | e2 | e3 | e4 | e5 | e6 | e7 | e8 | e9 | e10 | e11 |
| Старые | e1 | e6 | e3 | e2 | e4 | e5 | e8 | e7 | e9 | e10 | e11 |

Новая матрица соединений:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | e1 | e2 | e3 | e4 | e5 | e6 | e7 | e8 | e9 | e10 | e11 |
| e1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 |
| e2 | 1 | 0 | 2 | 0 | 0 | 0 | 1 | 3 | 3 | 2 | 4 |
| e3 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 3 | 3 | 2 |
| e4 | 0 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 4 | 1 | 2 |
| e5 | 0 | 0 | 1 | 2 | 0 | 1 | 1 | 2 | 5 | 2 | 2 |
| e6 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 2 | 1 | 0 |
| e7 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 2 | 1 | 0 |
| e8 | 1 | 3 | 1 | 0 | 2 | 0 | 1 | 0 | 1 | 2 | 4 |
| e9 | 1 | 3 | 3 | 4 | 5 | 2 | 2 | 1 | 0 | 5 | 6 |
| e10 | 0 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 5 | 0 | 2 |
| e11 | 2 | 4 | 2 | 2 | 2 | 0 | 0 | 4 | 6 | 2 | 0 |

1. **Построение графа пересечений**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1,8** | **1,9** | **2,7** | **2,8** | **2,9** | **2,10** | **2,11** | **3,5** | **3,8** | **3,9** | **3,10** | **3,11** | **4,6** | **4,7** | **4,9** | **4,10** | **4,11** | **5,7** | **5,8** | **5,9** | **5,10** | **5,11** | **6,9** | **6,10** | **7,9** | **7,10** | **8.10** | **8,11** | **9,11** |  |
| **1,8** | 1 |  |  |  | 1 | 1 | 1 |  |  | 1 | 1 | 1 |  |  | 1 | 1 | 1 |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  | **1** |
| **1,9** |  | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  | 1 |  | 1 | 1 | 1 |  | **2** |
| **2,7** |  |  | 1 |  |  |  |  |  | 1 | 1 | 1 | 1 |  |  | 1 | 1 | 1 |  | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  | **3** |
| **2,8** |  |  |  | 1 |  |  |  |  |  | 1 | 1 | 1 |  |  | 1 | 1 | 1 |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  | **4** |
| **2,9** | 1 |  |  |  | 1 |  |  |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  | 1 |  | 1 | 1 | 1 |  | **5** |
| **2,10** | 1 | 1 |  |  |  | 1 |  |  |  |  |  | 1 |  |  |  |  | 1 |  |  |  |  | 1 |  |  |  |  |  | 1 | 1 | **6** |
| **2,11** | 1 | 1 |  |  |  |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **7** |
| **3,5** |  |  |  |  |  |  |  | 1 |  |  |  |  | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |  |  |  |  |  |  |  | **8** |
| **3,8** |  |  | 1 |  |  |  |  |  | 1 |  |  |  |  |  | 1 | 1 | 1 |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  | **9** |
| **3,9** | 1 |  | 1 | 1 |  |  |  |  |  | 1 |  |  |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  | 1 |  | 1 | 1 | 1 |  | **10** |
| **3,10** | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  | 1 |  |  |  |  |  | 1 |  |  |  |  | 1 |  |  |  |  |  | 1 | 1 | **11** |
| **3,11** | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **12** |
| **4,6** |  |  |  |  |  |  |  | 1 |  |  |  |  | 1 |  |  |  |  | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |  |  | **13** |
| **4,7** |  |  |  |  |  |  |  | 1 |  |  |  |  |  | 1 |  |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  | **14** |
| **4,9** | 1 |  | 1 | 1 |  |  |  | 1 | 1 |  |  |  |  |  | 1 |  |  |  |  |  | 1 | 1 |  | 1 |  | 1 | 1 | 1 |  | **15** |
| **4,10** | 1 | 1 | 1 | 1 | 1 |  |  | 1 | 1 | 1 |  |  |  |  |  | 1 |  |  |  |  |  | 1 |  |  |  |  |  | 1 | 1 | **16** |
| **4,11** | 1 | 1 | 1 | 1 | 1 | 1 |  | 1 | 1 | 1 | 1 |  |  |  |  |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  | **17** |
| **5,7** |  |  |  |  |  |  |  |  |  |  |  |  | 1 |  |  |  |  | 1 |  |  |  |  | 1 | 1 |  |  |  |  |  | **18** |
| **5,8** |  |  | 1 |  |  |  |  |  |  |  |  |  | 1 | 1 |  |  |  |  | 1 |  |  |  | 1 | 1 | 1 | 1 |  |  |  | **19** |
| **5,9** | 1 |  | 1 | 1 |  |  |  |  | 1 |  |  |  | 1 | 1 |  |  |  |  |  | 1 |  |  |  | 1 |  | 1 | 1 | 1 |  | **20** |
| **5,10** | 1 | 1 | 1 | 1 | 1 |  |  |  | 1 | 1 |  |  | 1 | 1 | 1 |  |  |  |  |  | 1 |  |  |  |  |  |  | 1 | 1 | **21** |
| **5,11** | 1 | 1 | 1 | 1 | 1 | 1 |  |  | 1 | 1 | 1 |  | 1 | 1 | 1 | 1 |  |  |  |  |  | 1 |  |  |  |  |  |  |  | **22** |
| **6,9** | 1 |  | 1 | 1 |  |  |  |  | 1 |  |  |  |  | 1 |  |  |  | 1 | 1 |  |  |  | 1 |  |  | 1 | 1 | 1 |  | **23** |
| **6,10** | 1 | 1 | 1 | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  |  | 1 | 1 | 1 |  |  |  | 1 |  |  |  | 1 | 1 | **24** |
| **7,9** | 1 |  |  | 1 |  |  |  |  | 1 |  |  |  |  |  |  |  |  |  | 1 |  |  |  |  |  | 1 |  | 1 | 1 |  | **25** |
| **7,10** | 1 | 1 |  | 1 | 1 |  |  |  | 1 | 1 |  |  |  |  | 1 |  |  |  | 1 | 1 |  |  | 1 |  |  | 1 |  | 1 | 1 | **26** |
| **8,10** |  | 1 |  |  | 1 |  |  |  |  | 1 |  |  |  |  | 1 |  |  |  |  | 1 |  |  | 1 |  | 1 |  | 1 |  | 1 | **27** |
| **8,11** |  | 1 |  |  | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  |  |  | 1 | 1 |  | 1 | 1 | 1 | 1 |  | 1 |  | **28** |
| **9,11** |  |  |  |  |  | 1 |  |  |  |  | 1 |  |  |  |  | 1 |  |  |  |  | 1 |  |  | 1 |  | 1 | 1 |  | 1 | **29** |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** |  |

1. **Нахождение максимальных внутренне устойчивых подмножеств**

Найдем семейство ***ψ***

В первой строке нули соответствуют элементам:

**2**, 3, 4, 8, 9, 13, 14, 18, 19, 27, 28, 29

Выбираем первый из них – 2

Строим дизъюнкцию первой и второй строки

Затем с третьей строкой, так как третий элемент нулевой и т. д.:

Построено

Находим все семейства:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ψ 1** | 1 | 2 | 3 | 4 | 8 | 18 | 29 |  |
| **ψ 2** | 1 | 2 | 4 | 8 | 9 | 18 | 19 | 29 |
| **ψ 3** | 1 | 3 | 4 | 8 | 18 | 27 | 28 |  |
| **ψ 4** | 1 | 4 | 8 | 9 | 18 | 19 | 27 | 28 |
| **ψ 5** | 1 | 4 | 9 | 13 | 14 | 27 | 28 |  |
| **ψ 6** | 2 | 3 | 4 | 5 | 8 | 18 | 29 |  |
| **ψ 7** | 2 | 3 | 5 | 8 | 18 | 25 | 29 |  |
| **ψ 8** | 2 | 4 | 5 | 8 | 9 | 18 | 19 | 29 |
| **ψ 9** | 2 | 5 | 8 | 9 | 10 | 18 | 19 | 29 |
| **ψ 10** | 2 | 5 | 9 | 10 | 13 | 14 | 29 |  |
| **ψ 11** | 2 | 5 | 10 | 13 | 14 | 15 | 25 | 29 |
| **ψ 12** | 3 | 4 | 5 | 6 | 7 | 8 | 18 |  |
| **ψ 13** | 3 | 4 | 6 | 7 | 8 | 18 | 27 |  |
| **ψ 14** | 3 | 4 | 7 | 8 | 18 | 27 | 28 |  |
| **ψ 15** | 3 | 5 | 6 | 7 | 8 | 18 | 25 |  |
| **ψ 16** | 3 | 5 | 7 | 8 | 18 | 25 | 29 |  |
| **ψ 17** | 3 | 6 | 7 | 8 | 18 | 25 | 26 |  |
| **ψ 18** | 4 | 5 | 6 | 7 | 8 | 9 | 18 | 19 |
| **ψ 19** | 4 | 5 | 7 | 8 | 9 | 18 | 19 | 29 |
| **ψ 20** | 4 | 6 | 7 | 8 | 9 | 18 | 19 | 27 |
| **ψ 21** | 4 | 7 | 8 | 9 | 18 | 19 | 27 | 28 |
| **ψ 22** | 4 | 7 | 9 | 13 | 14 | 27 | 28 |  |
| **ψ 23** | 5 | 6 | 7 | 8 | 9 | 10 | 18 | 19 |
| **ψ 24** | 5 | 7 | 8 | 9 | 10 | 18 | 19 | 29 |
| **ψ 25** | 5 | 7 | 9 | 10 | 13 | 14 | 29 |  |
| **ψ 26** | 5 | 7 | 10 | 13 | 14 | 15 | 25 | 29 |
| **ψ 27** | 6 | 7 | 8 | 9 | 10 | 11 | 18 | 19 |
| **ψ 28** | 6 | 7 | 9 | 10 | 11 | 13 | 14 |  |
| **ψ 29** | 6 | 7 | 10 | 11 | 13 | 14 | 15 | 25 |
| **ψ 30** | 6 | 7 | 11 | 13 | 14 | 15 | 16 | 25 |
| **ψ 31** | 7 | 8 | 9 | 10 | 11 | 12 | 18 | 19 |
| **ψ 32** | 7 | 8 | 10 | 11 | 12 | 18 | 19 | 20 |
| **ψ 33** | 7 | 8 | 11 | 12 | 18 | 19 | 20 | 21 |
| **ψ 34** | 7 | 8 | 12 | 18 | 19 | 20 | 21 | 22 |
| **ψ 35** | 7 | 9 | 10 | 11 | 12 | 13 | 14 |  |
| **ψ 36** | 7 | 9 | 11 | 12 | 13 | 14 | 27 |  |
| **ψ 37** | 7 | 9 | 12 | 13 | 14 | 27 | 28 |  |
| **ψ 38** | 7 | 10 | 11 | 12 | 13 | 14 | 15 | 25 |
| **ψ 39** | 7 | 10 | 12 | 13 | 14 | 15 | 25 | 29 |
| **ψ 40** | 7 | 11 | 12 | 13 | 14 | 15 | 16 | 25 |
| **ψ 41** | 7 | 12 | 13 | 14 | 15 | 16 | 17 | 25 |
| **ψ 42** | 7 | 12 | 14 | 15 | 16 | 17 | 18 | 25 |
| **ψ 43** | 7 | 12 | 15 | 16 | 17 | 18 | 19 | 20 |
| **ψ 44** | 7 | 12 | 16 | 17 | 18 | 19 | 20 | 21 |
| **ψ 45** | 7 | 12 | 17 | 18 | 19 | 20 | 21 | 22 |

1. **Поиск максимального двудольного подграфа**

Высчитываем для каждой пары множеств из семейства ψ значение

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** | **41** | **42** | **43** | **44** | **45** |
| **1** | 0 | 9 | 9 | 11 | 12 | 8 | 9 | 10 | 11 | 12 | 13 | 10 | 10 | 10 | 11 | 10 | 11 | 12 | 11 | 12 | 12 | 13 | 13 | 12 | 13 | 14 | 13 | 14 | 15 | 15 | 13 | 13 | 13 | 13 | 14 | 14 | 14 | 15 | 14 | 15 | 15 | 14 | 14 | 14 | 14 |
| **2** | -1 | 0 | 11 | 10 | 12 | 10 | 11 | 9 | 10 | 12 | 14 | 12 | 12 | 12 | 13 | 12 | 13 | 11 | 10 | 11 | 11 | 13 | 12 | 11 | 13 | 15 | 12 | 14 | 16 | 16 | 12 | 13 | 13 | 13 | 14 | 14 | 14 | 16 | 15 | 16 | 16 | 15 | 14 | 14 | 14 |
| **3** | -1 | -1 | 0 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 10 | 9 | 8 | 11 | 11 | 11 | 12 | 12 | 11 | 10 | 11 | 13 | 13 | 14 | 15 | 13 | 14 | 15 | 15 | 13 | 13 | 13 | 13 | 14 | 13 | 12 | 15 | 15 | 15 | 15 | 14 | 14 | 14 | 14 |
| **4** | -1 | -1 | -1 | 0 | 10 | 12 | 13 | 11 | 12 | 14 | 16 | 12 | 11 | 10 | 13 | 13 | 13 | 11 | 11 | 10 | 9 | 11 | 12 | 12 | 14 | 16 | 12 | 14 | 16 | 16 | 12 | 13 | 13 | 13 | 14 | 13 | 12 | 16 | 16 | 16 | 16 | 15 | 14 | 14 | 14 |
| **5** | -1 | -1 | -1 | -1 | 0 | 13 | 14 | 13 | 14 | 11 | 13 | 13 | 12 | 11 | 14 | 14 | 14 | 13 | 13 | 12 | 11 | 8 | 14 | 14 | 11 | 13 | 14 | 11 | 13 | 13 | 14 | 15 | 15 | 15 | 11 | 10 | 9 | 13 | 13 | 13 | 13 | 14 | 15 | 15 | 15 |
| **6** | -1 | -1 | -1 | -1 | -1 | 0 | 8 | 9 | 10 | 11 | 12 | 9 | 10 | 10 | 10 | 9 | 11 | 11 | 10 | 12 | 12 | 13 | 12 | 11 | 12 | 13 | 13 | 14 | 15 | 15 | 13 | 13 | 13 | 13 | 14 | 14 | 14 | 15 | 14 | 15 | 15 | 14 | 14 | 14 | 14 |
| **7** | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 10 | 10 | 11 | 11 | 10 | 11 | 11 | 9 | 8 | 10 | 12 | 11 | 13 | 13 | 14 | 12 | 11 | 12 | 12 | 13 | 14 | 14 | 14 | 13 | 13 | 13 | 13 | 14 | 14 | 14 | 14 | 13 | 14 | 14 | 13 | 14 | 14 | 14 |
| **8** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 11 | 13 | 11 | 12 | 12 | 12 | 11 | 13 | 10 | 9 | 11 | 11 | 13 | 11 | 10 | 12 | 14 | 12 | 14 | 16 | 16 | 12 | 13 | 13 | 13 | 14 | 14 | 14 | 16 | 15 | 16 | 16 | 15 | 14 | 14 | 14 |
| **9** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 10 | 12 | 12 | 13 | 13 | 12 | 11 | 13 | 11 | 10 | 12 | 12 | 14 | 10 | 9 | 11 | 13 | 11 | 13 | 15 | 16 | 11 | 12 | 13 | 13 | 13 | 14 | 14 | 15 | 14 | 16 | 16 | 15 | 14 | 14 | 14 |
| **10** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 13 | 14 | 14 | 13 | 12 | 14 | 13 | 12 | 14 | 14 | 11 | 12 | 11 | 8 | 10 | 13 | 10 | 12 | 13 | 13 | 14 | 15 | 15 | 10 | 11 | 11 | 12 | 11 | 13 | 13 | 14 | 15 | 15 | 15 |
| **11** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 14 | 15 | 15 | 13 | 12 | 14 | 15 | 14 | 16 | 16 | 13 | 14 | 13 | 10 | 9 | 15 | 12 | 11 | 12 | 15 | 15 | 16 | 16 | 12 | 13 | 13 | 11 | 10 | 12 | 12 | 13 | 15 | 16 | 16 |
| **12** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 8 | 9 | 8 | 9 | 9 | 9 | 10 | 10 | 11 | 12 | 10 | 11 | 12 | 13 | 11 | 12 | 13 | 13 | 12 | 12 | 12 | 12 | 13 | 13 | 13 | 14 | 14 | 14 | 14 | 13 | 13 | 13 | 13 |
| **13** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 8 | 9 | 10 | 9 | 10 | 11 | 9 | 10 | 11 | 11 | 12 | 13 | 14 | 11 | 12 | 13 | 13 | 12 | 12 | 12 | 12 | 13 | 12 | 12 | 14 | 14 | 14 | 14 | 13 | 13 | 13 | 13 |
| **14** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 10 | 10 | 10 | 11 | 11 | 10 | 9 | 10 | 12 | 12 | 13 | 14 | 12 | 13 | 14 | 14 | 12 | 12 | 12 | 12 | 13 | 12 | 11 | 14 | 14 | 14 | 14 | 13 | 13 | 13 | 13 |
| **15** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 8 | 8 | 10 | 11 | 11 | 12 | 13 | 10 | 11 | 12 | 12 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 12 | 13 | 13 | 13 |
| **16** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 11 | 10 | 12 | 12 | 13 | 11 | 10 | 11 | 11 | 12 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 13 | 13 | 13 | 13 | 12 | 13 | 13 | 12 | 13 | 13 | 13 |
| **17** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 11 | 12 | 11 | 12 | 13 | 11 | 12 | 13 | 13 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 12 | 13 | 13 | 13 |
| **18** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 9 | 10 | 12 | 9 | 10 | 12 | 14 | 10 | 12 | 14 | 14 | 11 | 12 | 12 | 12 | 13 | 13 | 13 | 15 | 15 | 15 | 15 | 14 | 13 | 13 | 13 |
| **19** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 10 | 10 | 12 | 10 | 9 | 11 | 13 | 11 | 13 | 15 | 15 | 11 | 12 | 12 | 12 | 13 | 13 | 13 | 15 | 14 | 15 | 15 | 14 | 13 | 13 | 13 |
| **20** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 11 | 10 | 11 | 13 | 15 | 10 | 12 | 14 | 14 | 11 | 12 | 12 | 12 | 13 | 12 | 12 | 15 | 15 | 15 | 15 | 14 | 13 | 13 | 13 |
| **21** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 10 | 11 | 11 | 13 | 15 | 11 | 13 | 15 | 15 | 11 | 12 | 12 | 12 | 13 | 12 | 11 | 15 | 15 | 15 | 15 | 14 | 13 | 13 | 13 |
| **22** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 13 | 13 | 10 | 12 | 13 | 10 | 12 | 12 | 13 | 14 | 14 | 14 | 10 | 9 | 8 | 12 | 12 | 12 | 12 | 13 | 14 | 14 | 14 |
| **23** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 11 | 13 | 9 | 11 | 13 | 14 | 10 | 11 | 12 | 12 | 12 | 13 | 13 | 14 | 14 | 15 | 15 | 14 | 13 | 13 | 13 |
| **24** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 10 | 12 | 10 | 12 | 14 | 15 | 10 | 11 | 12 | 12 | 12 | 13 | 13 | 14 | 13 | 15 | 15 | 14 | 13 | 13 | 13 |
| **25** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 12 | 9 | 11 | 12 | 12 | 13 | 14 | 14 | 9 | 10 | 10 | 11 | 10 | 12 | 12 | 13 | 14 | 14 | 14 |
| **26** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 14 | 11 | 10 | 11 | 14 | 14 | 15 | 15 | 11 | 12 | 12 | 10 | 9 | 11 | 11 | 12 | 14 | 15 | 15 |
| **27** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 10 | 12 | 13 | 9 | 10 | 11 | 12 | 11 | 12 | 13 | 13 | 14 | 14 | 15 | 14 | 13 | 13 | 13 |
| **28** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 10 | 11 | 12 | 13 | 14 | 8 | 9 | 10 | 10 | 11 | 11 | 12 | 13 | 14 | 14 | 14 |
| **29** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 13 | 13 | 14 | 15 | 10 | 11 | 12 | 9 | 10 | 10 | 11 | 12 | 14 | 15 | 15 |
| **30** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 14 | 14 | 14 | 15 | 11 | 11 | 12 | 10 | 11 | 9 | 10 | 11 | 13 | 14 | 15 |
| **31** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 10 | 11 | 10 | 11 | 12 | 12 | 13 | 13 | 14 | 13 | 12 | 12 | 12 |
| **32** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 10 | 11 | 12 | 13 | 12 | 13 | 13 | 14 | 13 | 11 | 11 | 11 |
| **33** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 12 | 12 | 13 | 13 | 14 | 13 | 14 | 13 | 11 | 10 | 10 |
| **34** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 13 | 13 | 13 | 14 | 14 | 14 | 14 | 13 | 11 | 10 | 9 |
| **35** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 8 | 9 | 9 | 10 | 10 | 11 | 12 | 13 | 13 | 13 |
| **36** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 8 | 10 | 11 | 10 | 11 | 12 | 13 | 13 | 13 |
| **37** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 11 | 11 | 11 | 11 | 12 | 13 | 13 | 13 |
| **38** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 9 | 10 | 11 | 13 | 14 | 14 |
| **39** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 10 | 10 | 11 | 13 | 14 | 14 |
| **40** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 10 | 12 | 13 | 14 |
| **41** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 11 | 12 | 13 |
| **42** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 10 | 11 | 12 |
| **43** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 | 10 |
| **44** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 9 |
| **45** | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 |

Максимальное значение критерия равное 17 у Ψ:

2-29, 2-30, 2-38, 2-40, 2-41, 4-11, 4-26, 4-29, 4-30, 4-38, 4-39, 4-40, 4-41, 8-29, 8-30, 8-38, 8-40, 8-41, 9-30, 9-40, 9-41, 11-20, 11-21, 11-33, 11-34, 11-44, 11-45

Уберем ребра, содержащиеся в Ψ2 и Ψ29:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2,7** | **2,9** | **3,11** | **4,10** | **4,11** | **5,9** | **5,10** | **5,11** | **6,9** | **6,10** | **7,10** | **8.10** | **8,11** |  |
| **2,7** | 1 |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  | **1** |
| **2,9** |  | 1 | 1 | 1 | 1 |  | 1 | 1 |  | 1 | 1 | 1 | 1 | **2** |
| **3,11** | 1 | 1 | 1 |  |  |  |  |  |  |  |  |  |  | **3** |
| **4,10** | 1 | 1 |  | 1 |  |  |  | 1 |  |  |  |  | 1 | **4** |
| **4,11** | 1 | 1 |  |  | 1 |  |  |  |  |  |  |  |  | **5** |
| **5,9** | 1 |  |  |  |  | 1 |  |  |  | 1 | 1 | 1 | 1 | **6** |
| **5,10** | 1 | 1 |  |  |  |  | 1 |  |  |  |  |  | 1 | **7** |
| **5,11** | 1 | 1 |  | 1 |  |  |  | 1 |  |  |  |  |  | **8** |
| **6,9** | 1 |  |  |  |  |  |  |  | 1 |  | 1 | 1 | 1 | **9** |
| **6,10** | 1 | 1 |  |  |  | 1 |  |  |  | 1 |  |  | 1 | **10** |
| **7,10** |  | 1 |  |  |  | 1 |  |  | 1 |  | 1 |  | 1 | **11** |
| **8,10** |  | 1 |  |  |  | 1 |  |  | 1 |  |  | 1 |  | **12** |
| **8,11** |  | 1 |  | 1 |  | 1 | 1 |  | 1 | 1 | 1 |  | 1 | **13** |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |  |

Останется:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Ψ1 | 1 | 11 | 12 |  |  |  |
| Ψ2 | 1 | 12 | 13 |  |  |  |
| Ψ3 | 2 | 6 | 9 |  |  |  |
| Ψ4 | 3 | 4 | 5 | 6 | 7 | 9 |
| Ψ5 | 3 | 5 | 6 | 7 | 8 | 9 |
| Ψ6 | 3 | 5 | 7 | 8 | 9 | 10 |

Новая А:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** |
| **1** | 0 | 4 | 6 | 9 | 9 | 9 |
| **2** | -1 | 0 | 6 | 9 | 9 | 9 |
| **3** | -1 | -1 | 0 | 7 | 7 | 8 |
| **4** | -1 | -1 | -1 | 0 | 7 | 8 |
| **5** | -1 | -1 | -1 | -1 | 0 | 7 |
| **6** | -1 | -1 | -1 | -1 | -1 | 0 |

Максимальное значение критерия равное 9 у Ψ:

1-4, 1-5, 1-6, 2-4, 2-5, 2-6

Уберем ребра, содержащиеся в Ψ1 и Ψ4:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **2,9** | **3,11** | **5,11** | **6,10** | **8,11** |  |
| **2,9** | 1 | 1 | 1 | 1 | 1 | **1** |
| **3,11** | 1 | 1 |  |  |  | **2** |
| **5,11** | 1 |  | 1 |  |  | **3** |
| **6,10** | 1 |  |  | 1 | 1 | **4** |
| **8,11** | 1 |  |  | 1 | 1 | **5** |
|  | **1** | **2** | **3** | **4** | **5** |  |

Останется

|  |  |  |  |
| --- | --- | --- | --- |
| Ψ1 | 2 | 3 | 4 |
| Ψ2 | 2 | 3 | 5 |

Новая А:

|  |  |  |
| --- | --- | --- |
|  | **1** | **2** |
| **1** | 0 | 4 |
| **2** | -1 | 0 |

Возьмем пару из 1 и 2 с максимальным критерием в 4. Новое семейство пустое. Все ребра задействованы.

1. **Проверка изоморфизма графов**

Проведем проверку на изоморфизм исходного графа и графа, полученного перенумеровыванием вершин после нахождения гамильтонова цикла.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **e1** | **e2** | **e3** | **e4** | **e5** | **e6** | **e7** | **e8** | **e9** | **e10** | **e11** |  |
| **e1** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 4 |
| **e2** | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 7 |
| **e3** | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 7 |
| **e4** | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 8 |
| **e5** | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 5 |
| **e6** | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 7 |
| **e7** | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 8 |
| **e8** | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 7 |
| **e9** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 10 |
| **e10** | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 9 |
| **e11** | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 8 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **e1** | **e2** | **e3** | **e4** | **e5** | **e6** | **e7** | **e8** | **e9** | **e10** | **e11** |  |
| **e1** | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 4 |
| **e2** | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 7 |
| **e3** | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 7 |
| **e4** | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 7 |
| **e5** | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| **e6** | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 5 |
| **e7** | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 7 |
| **e8** | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 8 |
| **e9** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 10 |
| **e10** | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 9 |
| **e11** | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 8 |

|  |  |  |  |
| --- | --- | --- | --- |
| Значение | G1 | G2 | Соответствие |
| Число вершин m | 11 | 11 | + |
| Число ребер k | 40 | 40 | + |
| Компоненты связности p | 1 | 1 | + |

По основным инвариантам графы совпадают.

Список вершин и соответствующих рангов

|  |  |  |
| --- | --- | --- |
| **Ранг** | G1 | G2 |
| **10** | e9 | e9 |
| **9** | e10 | e10 |
| **8** | e4, e7, e11 | e5, e8, e11 |
| **7** | e2, e3, e6, e8 | e2, e3, e4, e7 |
| **5** | e5 | e6 |
| **4** | e1 | e1 |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **e1** | **7?** | **7?** | **8?** | **e6** | **7?** | **8?** | **7?** | **e9** | **e10** | **8?** |
| **e1** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| **7?** | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| **7?** | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| **8?** | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| **e6** | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| **7?** | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| **8?** | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| **7?** | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| **e9** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| **e10** | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| **8?** | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |

Проверка уже идентифицированных ребер позволяет восстановить нумерацию. Следовательно, графи изоморфны.

1. **Поиск эйлерова цикла**

У графа есть вершины с нечетным количеством смежных ребер. Дополним граф так, чтобы их не было.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **e1** | **e2** | **e3** | **e4** | **e5** | **e6** | **e7** | **e8** | **e9** | **e10** | **e11** |  |
| **e1** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | **4** |
| **e2** | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | **6** |
| **e3** | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | **6** |
| **e4** | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | **8** |
| **e5** | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | **4** |
| **e6** | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | **6** |
| **e7** | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | **8** |
| **e8** | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | **6** |
| **e9** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | **10** |
| **e10** | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | **8** |
| **e11** | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | **8** |

Эйлеров цикл:

e1, e6, e3, e4, e2, e5, e4, e7, e1, e9, e2, e8, e4, e9, e3, e7, e6, e8, e7, e9, e5, e10, e2, e11, e3, e10, e4, e11, e6, e9, e8, e10, e7, e11, e9, e10, e11, e1