#### ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО

#### ПРОФЕССИОНАЛЬНОГО ОБРАЗОВАНИЯ

**«КАЗАНСКИЙ (ПРИВОЛЖСКИЙ) ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ»**

# Институт информационных технологий и интеллектуальных систем

Семестровая работа:

##### **«Задача о гамильтоновом цикле»**

Выполнил работу:

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1 курс 11-012 группа

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**Задача о гамильтоновом пути** и **задача о гамильтоновом цикле** — это задачи определения, существует ли [гамильтонов путь](https://ru.wikipedia.org/wiki/%D0%93%D0%B0%D0%BC%D0%B8%D0%BB%D1%8C%D1%82%D0%BE%D0%BD%D0%BE%D0%B2_%D0%B3%D1%80%D0%B0%D1%84) или гамильтонов цикл в заданном [графе](https://ru.wikipedia.org/wiki/%D0%93%D1%80%D0%B0%D1%84_(%D0%BC%D0%B0%D1%82%D0%B5%D0%BC%D0%B0%D1%82%D0%B8%D0%BA%D0%B0)) ([ориентированном](https://ru.wikipedia.org/wiki/%D0%9E%D1%80%D0%B8%D0%B5%D0%BD%D1%82%D0%B8%D1%80%D0%BE%D0%B2%D0%B0%D0%BD%D0%BD%D1%8B%D0%B9_%D0%B3%D1%80%D0%B0%D1%84) или [неориентированном](https://ru.wikipedia.org/wiki/%D0%9D%D0%B5%D0%BE%D1%80%D0%B8%D0%B5%D0%BD%D1%82%D0%B8%D1%80%D0%BE%D0%B2%D0%B0%D0%BD%D0%BD%D1%8B%D0%B9_%D0%B3%D1%80%D0%B0%D1%84)).

**Основной принцип работы(алгоритмы); Оценка временной сложности; Выводы алгоритмов.**

Есть *n*! различных последовательностей вершин, которые могут быть гамильтоновыми путями в заданном графе с *n* вершинами (и их столько в полном графе), так что алгоритм полного перебора, который перебирает все возможные последовательности, был бы очень медленным.

Ранний точный алгоритм нахождения гамильтонова цикла в ориентированном графе был алгоритмом перебора (алгоритм Мартелло).

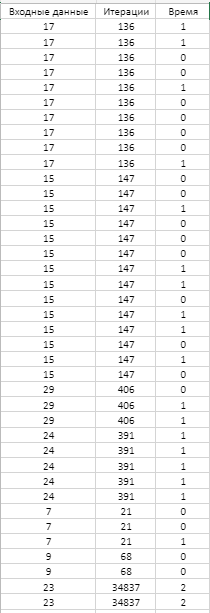
Процедура поиска Франка Рубина разбивает рёбра графа на три класса — те, которые должны быть на пути, те, которые пути принадлежать не могут, и рёбра, для которых решение не принято. В процессе поиска набор правил принятия решений классифицирует рёбра, для которых решение не принято, и определяет, остановиться или продолжить поиск. Алгоритм разбивает граф на компоненты, которые могут быть обработаны отдельно.

Для решения задачи за времяO(n^2\*2^n) может быть использован алгоритм динамического программирования Беллмана, Хелда и Карпа. В этом методе определяется для каждого набора *S* вершин и каждой вершины *v* из *S*, существует ли путь, проходящий через все вершины *S* и заканчивающийся в *v*. Для каждой пары (*S*, *v*) путь существует тогда и только тогда, когда *v* имеет соседнюю вершину *w* такую, что существует путь для   
*(S\v,w), к*оторый можно получить из уже полученной информации динамического программирования.

Андреас Бьёрклунд даёт альтернативный подход, использующий принцип включения/исключения для сокращения числа перебираемых гамильтоновых циклов и задача подсчёта циклов может быть решена путём вычисления определителя некоторой матрицы.

Используя этот метод, он показал, как решить задачу о гамильтоновом цикле для произвольных графов с *n* вершинами с помощью алгоритма Монте-Карло за время   
 O(1,657^n). Для двудольных графов этот алгоритм можно улучшить до времени o(1,415^n). Для графов с максимальной степенью три аккуратный [поиск с возвратом](https://ru.wikipedia.org/wiki/%D0%9F%D0%BE%D0%B8%D1%81%D0%BA_%D1%81_%D0%B2%D0%BE%D0%B7%D0%B2%D1%80%D0%B0%D1%82%D0%BE%D0%BC) может найти гамильтонов цикл (если таковой существует) за время O(1,251^n).

**Таблица значений (входные данные, время, итерации)**



**Графики**

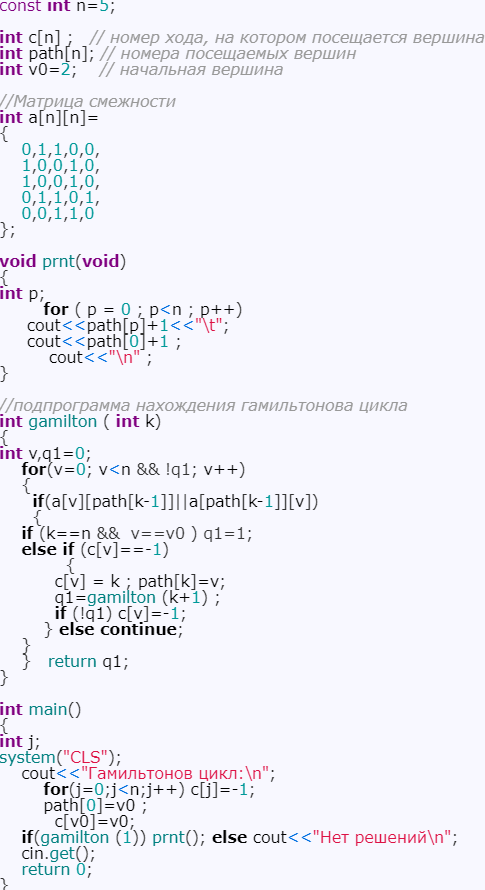




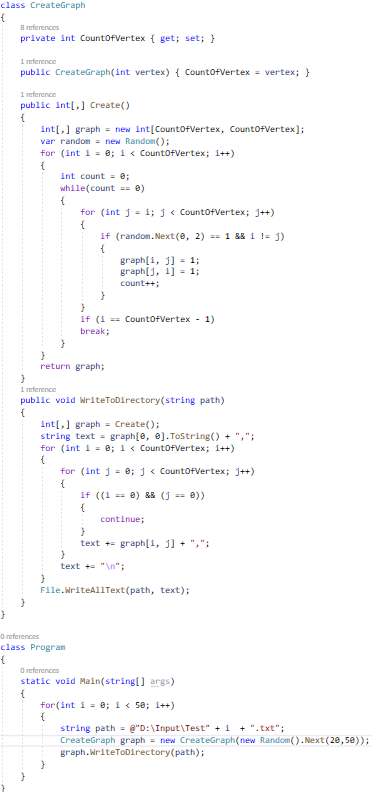
**Список использованной литературы**

<https://ru.wikipedia.org/wiki/%D0%97%D0%B0%D0%B4%D0%B0%D1%87%D0%B0_%D0%BE_%D0%B3%D0%B0%D0%BC%D0%B8%D0%BB%D1%8C%D1%82%D0%BE%D0%BD%D0%BE%D0%B2%D0%BE%D0%BC_%D0%BF%D1%83%D1%82%D0%B8>

**Код алгоритма**



**Код Генерации входных файлов для сортировки**



**Входные данные**

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