# Отчет по ИДЗ-4

Светличный Лев Алексеевич, БПИ225

## Условие

**Задача о Винни-Пухе и мстительных пчелах.**

Неправильные пчелы, подсчитав в конце месяца убытки от наличия в лесу Винни-Пуха, решили разыскать его и наказать в назидание всем другим любителям сладкого.

Для поисков медведя они поделили лес на участки, каждый из которых прочесывает одна стая неправильных пчел. В случае нахождения медведя на своем участке стая проводит показательное наказание и возвращается в улей.

Если участок прочесан, а Винни-Пух на нем не обнаружен, стая также возвращается в улей. Там она получает информацию об еще неисследованных участках и снова улетает.

Требуется создать многопоточное приложение, моделирующее действия пчел. При решении использовать парадигму «портфель задач». Каждая стая пчел — отдельный поток.


## Организация решения

## Структура программы

Программа будет иметь следующую структуру:

- Лес прямоугольной формы (практически), который можно поделить на MxN равных участков, где M — горизонтальное деление, N — вертикальное
- Улей — стартовая локация стай пчёл, где они получают распоряжения — какой участок прочесать и был ли найден Винни-Пух
- K роев пчёл, работающих параллельно
- Действие “Наказание Винни-Пуха”

Сценарий поведения пчёл:

- Получение информации в улье
- Вылет из улья — начало работы
- Прочесывание участка и получение результата — находится ли Винни-Пух на этом участке или нет
    - При нахождении Винни-Пуха выполнить действие “Наказание”
- Вернуться в улей с докладом
- Получить новые указания

Поиски завершаются по нахождении Винни-Пуха

Таким образом, один поток реализует роль улья, созданные “треды” (threads) — роль пчел, лес (с нахождением Винни-Пуха), а также очередь с заданиями (координатами участка) и общий статус поимки Винни-Пуха — данные, разделяемые рабочими потоками.

## Входные данные

Реализован интерфейс командной строки для пользователя

Требуется ввести размеры леса — MxN участков, $1 \le M,N \le 100$

Затем требуется ввести местоположение Винни-Пуха в формате “m n”, где $1 \le m \le M$, $1 \le n \le N$

Затем — количество роев пчёл K, 1 ≤ K ≤ 50

Также — имя файла для вывода результатов программы

Участки, на которые направляются пчелы, выбираются случайным образом (генерация координат от 1 до M и от 1 до N при помощи std::random_device, std::mt19937 и std::uniformIntDistribution<unsigned int>(0, UINT32_MAX) с взятием по модулю M или N соответственно и добавлением 1).

## Выходные данные

На каждой стадии программы пользователя будет уведомлять через консоль:

- какой рой куда был отправлен
- какой рой с каким результатом вернулся
- по завершении программы — где Винни-Пух был найден и после прочесывания скольких участков

## Результаты работы программы

Входные данные: M=3, N=3, (m,n)=(2,1), K=1

Выходные данные:

```
Swarm 1 is ready to depart.
Swarm 1 has received task to look search lot (2, 1)
Swarm 1 has returned from with result: Bear found at lot (2, 1)
```

Входные данные: M=3, N=3, (m,n)=(1,2), K=3

Выходные данные:

```
Swarm 1 is ready to depart.
Swarm 2 is ready to depart.
Swarm 2 has received task to look search lot (3, 3)
Swarm 3 is ready to depart.
Swarm 3 has received task to look search lot (3, 1)
Swarm 1 has received task to look search lot (2, 2)
Swarm 3 has returned from with result: Bear not found at lot (3, 1)
```

```
Swarm 3 has received task to look search lot (2, 3)
Swarm 1 has returned from with result: Bear not found at lot (2,
2)
Swarm 2 has returned from with result: Bear not found at lot (3,
3)
Swarm 1 has received task to look search lot (1, 3)
Swarm 2 has received task to look search lot (2, 1)
Swarm 3 has returned from with result: Bear not found at lot (2,
3)
Swarm 3 has received task to look search lot (3, 2)
Swarm 1 has returned from with result: Bear not found at lot (1,
3)
Swarm 1 has received task to look search lot (1, 2)
Swarm 3 has returned from with result: Bear not found at lot (3,
2)
Swarm 3 has received task to look search lot (1, 1)
Swarm 3 has returned from with result: Bear not found at lot (1,
1)
Swarm 2 has returned from with result: Bear not found at lot (2,
1)
Swarm 1 has returned from with result: Bear found at lot (1, 2)
```

Входные данные: M=10, N=10, (m,n)=(3,7), K=10

Выходные данные:

```
Swarm 8 is ready to depart.
Swarm 10 is ready to depart.
Swarm 5 is ready to depart.
Swarm 6 is ready to depart.
Swarm 3 is ready to depart.
Swarm 2 is ready to depart.
Swarm 4 is ready to depart.
Swarm 2 has received task to look search lot (8, 3)
Swarm 1 is ready to depart.
Swarm 7 is ready to depart.
Swarm 9 is ready to depart.
Swarm 8 has received task to look search lot (1, 10)
```

```
Swarm 2 has returned from with result: Bear not found at lot (8,
3)
Swarm 7 has received task to look search lot (2, 2)
Swarm 10 has received task to look search lot (3, 6)
Swarm 8 has returned from with result: Bear not found at lot (1,
10)
Swarm 8 has received task to look search lot (3, 1)
Swarm 7 has returned from with result: Bear not found at lot (2,
2)
Swarm 10 has returned from with result: Bear not found at lot
(3, 6)
Swarm 1 has received task to look search lot (6, 5)
Swarm 9 has received task to look search lot (7, 1)
Swarm 7 has received task to look search lot (6, 10)
Swarm 5 has received task to look search lot (2, 10)
Swarm 9 has returned from with result: Bear not found at lot (7,
1)
Swarm 8 has returned from with result: Bear not found at lot (3,
1)
Swarm 10 has received task to look search lot (1, 1)
Swarm 7 has returned from with result: Bear not found at lot (6,
10)
Swarm 6 has received task to look search lot (5, 4)
Swarm 1 has returned from with result: Bear not found at lot (6,
5)
Swarm 5 has returned from with result: Bear not found at lot (2,
10)
Swarm 7 has received task to look search lot (7, 4)
Swarm 6 has returned from with result: Bear not found at lot (5,
4)
Swarm 4 has received task to look search lot (6, 7)
Swarm 9 has received task to look search lot (9, 6)
Swarm 10 has returned from with result: Bear not found at lot
(1, 1)
Swarm 7 has returned from with result: Bear not found at lot (7,
4)
```

```
Swarm 10 has received task to look search lot (4, 5)
Swarm 4 has returned from with result: Bear not found at lot (6,
7)
Swarm 1 has received task to look search lot (9, 4)
Swarm 9 has returned from with result: Bear not found at lot (9,
6)
Swarm 8 has received task to look search lot (10, 3)
Swarm 1 has returned from with result: Bear not found at lot (9,
4)
Swarm 8 has returned from with result: Bear not found at lot
(10, 3)
Swarm 8 has received task to look search lot (9, 2)
Swarm 10 has returned from with result: Bear not found at lot
(4, 5)
Swarm 1 has received task to look search lot (2, 5)
Swarm 10 has received task to look search lot (7, 7)
Swarm 1 has returned from with result: Bear not found at lot (2,
5)
Swarm 2 has received task to look search lot (6, 3)
Swarm 10 has returned from with result: Bear not found at lot
(7, 7)
Swarm 2 has returned from with result: Bear not found at lot (6,
3)
Swarm 8 has returned from with result: Bear not found at lot (9,
2)
Swarm 7 has received task to look search lot (10, 5)
Swarm 3 has received task to look search lot (7, 8)
Swarm 4 has received task to look search lot (10, 1)
Swarm 4 has returned from with result: Bear not found at lot
(10, 1)
Swarm 3 has returned from with result: Bear not found at lot (7,
8)
Swarm 8 has received task to look search lot (8, 1)
Swarm 10 has received task to look search lot (6, 1)
Swarm 8 has returned from with result: Bear not found at lot (8,
1)
```

```
Swarm 5 has received task to look search lot (4, 1)
Swarm 7 has returned from with result: Bear not found at lot
(10, 5)
Swarm 7 has received task to look search lot (4, 6)
Swarm 8 has received task to look search lot (2, 8)
Swarm 10 has returned from with result: Bear not found at lot
(6, 1)
Swarm 10 has received task to look search lot (7, 6)
Swarm 8 has returned from with result: Bear not found at lot (2,
8)
Swarm 9 has received task to look search lot (1, 4)
Swarm 10 has returned from with result: Bear not found at lot
(7, 6)
Swarm 10 has received task to look search lot (1, 3)
Swarm 5 has returned from with result: Bear not found at lot (4,
1)
Swarm 3 has received task to look search lot (8, 4)
Swarm 7 has returned from with result: Bear not found at lot (4,
6)
Swarm 4 has received task to look search lot (5, 2)
Swarm 6 has received task to look search lot (4, 3)
Swarm 4 has returned from with result: Bear not found at lot (5,
2)
Swarm 1 has received task to look search lot (2, 6)
Swarm 10 has returned from with result: Bear not found at lot
(1, 3)
Swarm 9 has returned from with result: Bear not found at lot (1,
4)
Swarm 6 has returned from with result: Bear not found at lot (4,
3)
Swarm 10 has received task to look search lot (5, 3)
Swarm 3 has returned from with result: Bear not found at lot (8,
4)
Swarm 3 has received task to look search lot (9, 8)
Swarm 3 has returned from with result: Bear not found at lot (9,
8)
```

```
Swarm 4 has received task to look search lot (8, 6)
Swarm 6 has received task to look search lot (3, 10)
Swarm 1 has returned from with result: Bear not found at lot (2,
6)
Swarm 2 has received task to look search lot (3, 5)
Swarm 4 has returned from with result: Bear not found at lot (8,
6)
Swarm 9 has received task to look search lot (10, 4)
Swarm 10 has returned from with result: Bear not found at lot
(5, 3)
Swarm 3 has received task to look search lot (2, 9)
Swarm 7 has received task to look search lot (6, 4)
Swarm 6 has returned from with result: Bear not found at lot (3,
10)
Swarm 2 has returned from with result: Bear not found at lot (3,
5)
Swarm 1 has received task to look search lot (8, 5)
Swarm 9 has returned from with result: Bear not found at lot
(10, 4)
Swarm 10 has received task to look search lot (7, 2)
Swarm 1 has returned from with result: Bear not found at lot (8,
5)
Swarm 7 has returned from with result: Bear not found at lot (6,
4)
Swarm 3 has returned from with result: Bear not found at lot (2,
9)
Swarm 9 has received task to look search lot (8, 7)
Swarm 9 has returned from with result: Bear not found at lot (8,
7)
Swarm 5 has received task to look search lot (5, 9)
Swarm 4 has received task to look search lot (5, 7)
Swarm 10 has returned from with result: Bear not found at lot
(7, 2)
Swarm 2 has received task to look search lot (3, 8)
Swarm 5 has returned from with result: Bear not found at lot (5,
9)
```

```
Swarm 10 has received task to look search lot (9, 5)
Swarm 4 has returned from with result: Bear not found at lot (5, 7)
Swarm 4 has received task to look search lot (9, 3)
Swarm 10 has returned from with result: Bear not found at lot (9, 5)
Swarm 2 has returned from with result: Bear not found at lot (3, 8)
Swarm 6 has received task to look search lot (2, 1)
Swarm 4 has returned from with result: Bear not found at lot (9, 3)
Swarm 10 has received task to look search lot (8, 2)
Swarm 6 has returned from with result: Bear not found at lot (2, 1)
Swarm 4 has received task to look search lot (1, 8)
Swarm 1 has received task to look search lot (7, 5)
Swarm 10 has returned from with result: Bear not found at lot (8, 2)
Swarm 7 has received task to look search lot (10, 10)
Swarm 1 has returned from with result: Bear not found at lot (7, 5)
Swarm 10 has received task to look search lot (1, 2)
Swarm 1 has received task to look search lot (6, 6)
Swarm 10 has returned from with result: Bear not found at lot (1, 2)
Swarm 7 has returned from with result: Bear not found at lot (10, 10)
Swarm 2 has received task to look search lot (9, 10)
Swarm 1 has returned from with result: Bear not found at lot (6, 6)
Swarm 4 has returned from with result: Bear not found at lot (1, 8)
Swarm 9 has received task to look search lot (4, 8)
Swarm 5 has received task to look search lot (4, 7)
Swarm 5 has returned from with result: Bear not found at lot (4, 7)
```

```
Swarm 5 has received task to look search lot (8, 10)
Swarm 8 has received task to look search lot (4, 9)
Swarm 10 has received task to look search lot (8, 8)
Swarm 9 has returned from with result: Bear not found at lot (4,
8)
Swarm 2 has returned from with result: Bear not found at lot (9,
10)
Swarm 9 has received task to look search lot (2, 4)
Swarm 2 has received task to look search lot (3, 2)
Swarm 10 has returned from with result: Bear not found at lot
(8, 8)
Swarm 5 has returned from with result: Bear not found at lot (8,
10)
Swarm 8 has returned from with result: Bear not found at lot (4,
9)
Swarm 7 has received task to look search lot (5, 10)
Swarm 9 has returned from with result: Bear not found at lot (2,
4)
Swarm 2 has returned from with result: Bear not found at lot (3,
2)
Swarm 2 has received task to look search lot (9, 7)
Swarm 7 has returned from with result: Bear not found at lot (5,
10)
Swarm 1 has received task to look search lot (2, 7)
Swarm 7 has received task to look search lot (4, 4)
Swarm 7 has returned from with result: Bear not found at lot (4,
4)
Swarm 7 has received task to look search lot (8, 9)
Swarm 2 has returned from with result: Bear not found at lot (9,
7)
Swarm 6 has received task to look search lot (7, 10)
Swarm 7 has returned from with result: Bear not found at lot (8,
9)
Swarm 9 has received task to look search lot (9, 9)
Swarm 6 has returned from with result: Bear not found at lot (7,
10)
```

```
Swarm 8 has received task to look search lot (7, 3)
Swarm 1 has returned from with result: Bear not found at lot (2,
7)
Swarm 3 has received task to look search lot (9, 1)
Swarm 10 has received task to look search lot (5, 1)
Swarm 3 has returned from with result: Bear not found at lot (9,
1)
Swarm 1 has received task to look search lot (5, 8)
Swarm 5 has received task to look search lot (3, 3)
Swarm 9 has returned from with result: Bear not found at lot (9,
9)
Swarm 6 has received task to look search lot (10, 9)
Swarm 8 has returned from with result: Bear not found at lot (7,
3)
Swarm 7 has received task to look search lot (5, 6)
Swarm 10 has returned from with result: Bear not found at lot
(5, 1)
Swarm 7 has returned from with result: Bear not found at lot (5,
6)
Swarm 7 has received task to look search lot (1, 6)
Swarm 6 has returned from with result: Bear not found at lot
(10, 9)
Swarm 1 has returned from with result: Bear not found at lot (5,
8)
Swarm 7 has returned from with result: Bear not found at lot (1,
6)
Swarm 5 has returned from with result: Bear not found at lot (3,
3)
Swarm 8 has received task to look search lot (10, 8)
Swarm 4 has received task to look search lot (1, 5)
Swarm 5 has received task to look search lot (6, 2)
Swarm 4 has returned from with result: Bear not found at lot (1,
5)
Swarm 9 has received task to look search lot (4, 10)
Swarm 8 has returned from with result: Bear not found at lot
(10, 8)
```

```
Swarm 10 has received task to look search lot (4, 2)
Swarm 9 has returned from with result: Bear not found at lot (4, 10)
Swarm 5 has returned from with result: Bear not found at lot (6, 2)
Swarm 5 has received task to look search lot (3, 7)
Swarm 6 has received task to look search lot (6, 9)
Swarm 8 has received task to look search lot (1, 7)
Swarm 8 has returned from with result: Bear not found at lot (1, 7)
Swarm 10 has returned from with result: Bear not found at lot (4, 2)
Swarm 2 has received task to look search lot (10, 6)
Swarm 6 has returned from with result: Bear not found at lot (6, 9)
Swarm 5 has returned from with result: Bear found at lot (3, 7)
Swarm 8 has received task to look search lot (7, 9)
Swarm 8 has returned from with result: Bear not found at lot (7, 9)
Swarm 2 has returned from with result: Bear not found at lot (10, 6)
```

# Отчёт по требованиям к программе

Программа реализована на языке C++ с использованием функций POSIX Thread для работы с потоками, без использования более высокоуровневых библиотек классов.

## 4-5 баллов

- Общие требования к отчёту соблюдены.
- В отчёте приведён сценарий, описывающий одновременное поведение сущностей, представленных в условии задания (как абстрактно, без погружения в детали реализации, так и в терминах предметной области).

- Описана модель параллельных вычислений, используемая при разработке многопоточной программы.
- Описаны входные данные программы, включающие вариативные диапазоны, возможные при многократных запусках.
- Реализовано консольное приложение, решающее поставленную задачу с использованием одного варианта изученных синхропримитивов (реализовано условие на 6-7 баллов ввод аргументов из командной строки).
- Ввод данных в приложение реализован с консоли во время выполнения программы (без использования аргументов командной строки)(реализовано условие на 6-7 баллов ввод аргументов из командной строки).
- Для используемых генераторов случайных чисел описаны их диапазоны и то, как интерпретируются данные этих генераторов.
- Вывод программы должен быть информативным, отражая все ключевые протекающие в ней события в терминах предметной области.
- Наблюдатель на основе вывода программы должен понимать, что в ней происходит в каждый момент времени ее работы.
- В программе присутствуют комментарии, поясняющие выполняемые действия и описание используемых объектов и переменных.
- Результаты работы программы представлены в отчете.

## 6-7 баллов

- В отчете подробно описан обобщенный алгоритм, используемый при реализации программы исходного словесного сценария. В котором показано, как на программу отображается каждый из субъектов предметной области.
- В программу добавлена генерация случайных данных в допустимых диапазонах.

- Реализован ввод исходных данных из командной строки при запуске программы вместо ввода параметров с консоли во время выполнения программы.
- Результаты изменений отражены в отчете.