Московский Авиационный Институт (Национальный Исследовательский Университет)

Институт №8 “Компьютерные науки и прикладная математика” Кафедра №806 “Вычислительная математика и программирование”

# Лабораторная работа №4 по курсу

**«Операционные системы»**

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# Постановка задачи

## Вариант 2.

## Необходимо реализовать два алгоритма аллокации памяти: списки свободных блоков (первое подходящее) и алгоритм Мак-Кьюзи Кэрелса

# Общий метод и алгоритм решения

# Используемые системные вызовы:

# VirtualAlloc — резервирует и выделяет регион виртуальной памяти.

# VirtualFree — освобождает ранее выделенную память.

# LoadLibraryA — загружает динамическую библиотеку (DLL).

# GetProcAddress — получает адрес функции в загруженной DLL.

# FreeLibrary — выгружает динамическую библиотеку после завершения работы с ней.

# Описание работы программы

# Инициализация:

# Объявляются структуры и функции для работы с памятью: Allocator, allocator\_create\_func, allocator\_destroy\_func, allocator\_alloc\_func, allocator\_free\_func.

# Устанавливаются базовые функции для работы с памятью (создание, уничтожение, выделение и освобождение памяти).

# Загрузка динамической библиотеки (опционально):

# Если программа запущена с аргументом (путь к DLL), то происходит загрузка этой библиотеки функцией LoadLibraryA.

# Извлекаются адреса нужных функций из библиотеки: allocator\_create, allocator\_destroy, allocator\_alloc, allocator\_free.

# Создание пула памяти:

# Выделяется большой блок памяти с помощью VirtualAlloc размером 64 МБ.

# Создание аллокатора:

# Вызывается функция allocator\_create для создания экземпляра аллокатора, который будет управлять выделенным пулом памяти.

# Тестирование аллокатора:

# Выполняется серия операций выделения и освобождения памяти (10 000 операций):

# Для каждой операции размер блока выбирается случайным образом в диапазоне от 16 до 256 байт.

# Блоки выделяются с помощью функции allocator\_alloc.

# Каждые несколько операций некоторые блоки освобождаются с помощью функции allocator\_free.

# Замеряются времена выполнения операций выделения и освобождения памяти.

# Завершение работы:

# Все оставшиеся блоки памяти освобождаются.

# Уничтожается аллокатор с помощью функции allocator\_destroy.

# Освобождается весь пул памяти с помощью VirtualFree.

# Выгружается динамическая библиотека, если она была загружена.

# Вывод результатов:

# Выводится время, затраченное на выполнение операций выделения и освобождения памяти.

# 

# Код программы

#include <Windows.h>

#include <iostream>

#include <vector>

#include <chrono>

#include <random>

typedef struct Allocator Allocator;

typedef Allocator\* (\*allocator\_create\_func)(void\*, size\_t);

typedef void (\*allocator\_destroy\_func)(Allocator\*);

typedef void\* (\*allocator\_alloc\_func)(Allocator\*, size\_t);

typedef void (\*allocator\_free\_func)(Allocator\*, void\*);

static Allocator\* default\_allocator\_create(void\* memory, size\_t size) {

return (Allocator\*)1;

}

static void default\_allocator\_destroy(Allocator\* alloc) {

}

static void\* default\_allocator\_alloc(Allocator\* alloc, size\_t size) {

return VirtualAlloc(nullptr, size, MEM\_COMMIT | MEM\_RESERVE, PAGE\_READWRITE);

}

static void default\_allocator\_free(Allocator\* alloc, void\* ptr) {

VirtualFree(ptr, 0, MEM\_RELEASE);

}

static allocator\_create\_func create\_allocator = default\_allocator\_create;

static allocator\_destroy\_func destroy\_allocator = default\_allocator\_destroy;

static allocator\_alloc\_func alloc\_mem = default\_allocator\_alloc;

static allocator\_free\_func free\_mem = default\_allocator\_free;

void test\_allocator(Allocator\* allocator, size\_t total\_size) {

const int num\_operations = 10000;

std::vector<void\*> blocks;

blocks.reserve(num\_operations);

std::mt19937 rng(std::random\_device{}());

std::uniform\_int\_distribution<size\_t> size\_dist(16, 256);

std::bernoulli\_distribution free\_dist(0.3);

auto start\_alloc = std::chrono::high\_resolution\_clock::now();

for (int i = 0; i < num\_operations; ++i) {

size\_t size = size\_dist(rng);

void\* block = alloc\_mem(allocator, size);

if (block) {

blocks.push\_back(block);

if (free\_dist(rng) && !blocks.empty()) {

size\_t idx = rng() % blocks.size();

free\_mem(allocator, blocks[idx]);

blocks[idx] = blocks.back();

blocks.pop\_back();

}

}

}

auto end\_alloc = std::chrono::high\_resolution\_clock::now();

auto start\_free = std::chrono::high\_resolution\_clock::now();

for (void\* block : blocks) {

free\_mem(allocator, block);

}

auto end\_free = std::chrono::high\_resolution\_clock::now();

auto alloc\_time = std::chrono::duration\_cast<std::chrono::microseconds>(end\_alloc - start\_alloc);

auto free\_time = std::chrono::duration\_cast<std::chrono::microseconds>(end\_free - start\_free);

std::cout << "Allocation time: " << alloc\_time.count() << " μs\n";

std::cout << "Free time: " << free\_time.count() << " μs\n";

}

int main(int argc, char\*\* argv) {

HMODULE dll = nullptr;

if (argc > 1) {

dll = LoadLibraryA(argv[1]);

if (dll) {

create\_allocator = (allocator\_create\_func)GetProcAddress(dll, "allocator\_create");

destroy\_allocator = (allocator\_destroy\_func)GetProcAddress(dll, "allocator\_destroy");

alloc\_mem = (allocator\_alloc\_func)GetProcAddress(dll, "allocator\_alloc");

free\_mem = (allocator\_free\_func)GetProcAddress(dll, "allocator\_free");

if (!create\_allocator || !destroy\_allocator || !alloc\_mem || !free\_mem) {

std::cerr << "Failed to load functions from DLL\n";

FreeLibrary(dll);

dll = nullptr;

}

}

}

const size\_t pool\_size = 64 \* 1024 \* 1024;

void\* memory\_pool = VirtualAlloc(nullptr, pool\_size, MEM\_COMMIT | MEM\_RESERVE, PAGE\_READWRITE);

if (!memory\_pool) {

std::cerr << "Failed to allocate memory pool\n";

return 1;

}

Allocator\* allocator = create\_allocator(memory\_pool, pool\_size);

if (!allocator) {

std::cerr << "Failed to create allocator\n";

VirtualFree(memory\_pool, 0, MEM\_RELEASE);

return 1;

}

std::cout << "Testing allocator...\n";

test\_allocator(allocator, pool\_size);

destroy\_allocator(allocator);

VirtualFree(memory\_pool, 0, MEM\_RELEASE);

if (dll) FreeLibrary(dll);

return 0;

# }

# Протокол работы программы

# Тестирование:

# 

# Process Monitor:

# 3:23:23,6484963 allocator\_test.exe 19824 Thread Create SUCCESS Thread ID: 1904

# 3:23:23,6530794 allocator\_test.exe 19824 Load Image C:\Users\kvv22\allocator\_test.exe SUCCESS Image Base: 0x400000, Image Size: 0x15000

# 3:23:23,6531881 allocator\_test.exe 19824 Load Image C:\Windows\System32\ntdll.dll SUCCESS Image Base: 0x7ffbba730000, Image Size: 0x217000

# 3:23:23,6533077 allocator\_test.exe 19824 Load Image C:\Windows\SysWOW64\ntdll.dll SUCCESS Image Base: 0x77b40000, Image Size: 0x1b2000

# 3:23:23,6534601 allocator\_test.exe 19824 CreateFile C:\Windows\Prefetch\ALLOCATOR\_TEST.EXE-1E187ABD.pf SUCCESS Desired Access: Generic Read, Disposition: Open, Options: Synchronous IO Non-Alert, Attributes: n/a, ShareMode: None, AllocationSize: n/a, OpenResult: Opened

# 3:23:23,6535392 allocator\_test.exe 19824 QueryEAFile C:\Windows\Prefetch\ALLOCATOR\_TEST.EXE-1E187ABD.pf SUCCESS

# 3:23:23,6541436 allocator\_test.exe 19824 QueryStandardInformationFile C:\Windows\Prefetch\ALLOCATOR\_TEST.EXE-1E187ABD.pf SUCCESS AllocationSize: 4 096, EndOfFile: 2 285, NumberOfLinks: 1, DeletePending: False, Directory: False

# 3:23:23,6542031 allocator\_test.exe 19824 ReadFile C:\Windows\Prefetch\ALLOCATOR\_TEST.EXE-1E187ABD.pf SUCCESS Offset: 0, Length: 2 285, Priority: Normal

# 3:23:23,6543610 allocator\_test.exe 19824 CloseFile C:\Windows\Prefetch\ALLOCATOR\_TEST.EXE-1E187ABD.pf SUCCESS

# 3:23:23,6588163 allocator\_test.exe 19824 RegQueryValue HKLM\System\CurrentControlSet\Control\Nls\CodePage\ACP SUCCESS Type: REG\_SZ, Length: 10, Data: 1251

# 3:23:23,6588330 allocator\_test.exe 19824 RegQueryValue HKLM\System\CurrentControlSet\Control\Nls\CodePage\OEMCP SUCCESS Type: REG\_SZ, Length: 8, Data: 866

# 3:23:23,6601162 allocator\_test.exe 19824 CreateFile C:\Windows SUCCESS Desired Access: Execute/Traverse, Synchronize, Disposition: Open, Options: Directory, Synchronous IO Non-Alert, Attributes: n/a, ShareMode: Read, Write, AllocationSize: n/a, OpenResult: Opened

# 3:23:23,6603421 allocator\_test.exe 19824 Load Image C:\Windows\System32\wow64.dll SUCCESS Image Base: 0x7ffbb93d0000, Image Size: 0x57000

# 3:23:23,6607478 allocator\_test.exe 19824 Load Image C:\Windows\System32\wow64base.dll SUCCESS Image Base: 0x7ffbb99c0000, Image Size: 0x9000

# 3:23:23,6611660 allocator\_test.exe 19824 Load Image C:\Windows\System32\wow64win.dll SUCCESS Image Base: 0x7ffbb9c30000, Image Size: 0x8b000

# 3:23:23,6614125 allocator\_test.exe 19824 Load Image C:\Windows\System32\wow64con.dll SUCCESS Image Base: 0x7ffbb8ef0000, Image Size: 0x16000

# 3:23:23,6625546 allocator\_test.exe 19824 CreateFile C:\Windows SUCCESS Desired Access: Read Attributes, Synchronize, Disposition: Open, Options: Synchronous IO Non-Alert, Attributes: n/a, ShareMode: Read, Write, Delete, AllocationSize: n/a, OpenResult: Opened

# 3:23:23,6626183 allocator\_test.exe 19824 CloseFile C:\Windows SUCCESS

# 3:23:23,6627678 allocator\_test.exe 19824 RegQueryValue HKLM\SOFTWARE\Microsoft\Wow64\x86\(Default) SUCCESS Type: REG\_SZ, Length: 26, Data: wow64cpu.dll

# 3:23:23,6629216 allocator\_test.exe 19824 Load Image C:\Windows\System32\wow64cpu.dll SUCCESS Image Base: 0x77b30000, Image Size: 0xa000

# 3:23:23,6632269 allocator\_test.exe 19824 RegSetInfoKey HKLM\System\CurrentControlSet\Control\Nls\CodePage SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6632373 allocator\_test.exe 19824 RegQueryValue HKLM\System\CurrentControlSet\Control\Nls\CodePage\ACP SUCCESS Type: REG\_SZ, Length: 10, Data: 1251

# 3:23:23,6632530 allocator\_test.exe 19824 RegQueryValue HKLM\System\CurrentControlSet\Control\Nls\CodePage\OEMCP SUCCESS Type: REG\_SZ, Length: 8, Data: 866

# 3:23:23,6634438 allocator\_test.exe 19824 RegSetInfoKey HKLM\System\CurrentControlSet\Control\Session Manager SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6636761 allocator\_test.exe 19824 RegSetInfoKey HKLM\System\CurrentControlSet\Control\Session Manager SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6639871 allocator\_test.exe 19824 RegSetInfoKey HKLM\System\CurrentControlSet\Control\Session Manager SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6644591 allocator\_test.exe 19824 CreateFile C:\Users\kvv22 SUCCESS Desired Access: Execute/Traverse, Synchronize, Disposition: Open, Options: Directory, Synchronous IO Non-Alert, Attributes: n/a, ShareMode: Read, Write, AllocationSize: n/a, OpenResult: Opened

# 3:23:23,6646904 allocator\_test.exe 19824 Load Image C:\Windows\SysWOW64\kernel32.dll SUCCESS Image Base: 0x76810000, Image Size: 0xf0000

# 3:23:23,6649412 allocator\_test.exe 19824 Load Image C:\Windows\SysWOW64\KernelBase.dll SUCCESS Image Base: 0x77440000, Image Size: 0x295000

# 3:23:23,6671586 allocator\_test.exe 19824 RegSetInfoKey HKLM\System\CurrentControlSet\Control\Terminal Server SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6672508 allocator\_test.exe 19824 RegQueryValue HKLM\System\CurrentControlSet\Control\Terminal Server\TSUserEnabled SUCCESS Type: REG\_DWORD, Length: 4, Data: 0

# 3:23:23,6676788 allocator\_test.exe 19824 RegSetInfoKey HKLM\SOFTWARE\Policies\Microsoft\Windows\safer\codeidentifiers SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6678340 allocator\_test.exe 19824 RegSetInfoKey HKLM\System\CurrentControlSet\Control\FileSystem SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6678570 allocator\_test.exe 19824 RegQueryValue HKLM\System\CurrentControlSet\Control\FileSystem\LongPathsEnabled SUCCESS Type: REG\_DWORD, Length: 4, Data: 1

# 3:23:23,6681400 allocator\_test.exe 19824 Load Image C:\Windows\SysWOW64\msvcrt.dll SUCCESS Image Base: 0x76930000, Image Size: 0xc4000

# 3:23:23,6682769 allocator\_test.exe 19824 Thread Create SUCCESS Thread ID: 20268

# 3:23:23,6684660 allocator\_test.exe 19824 Thread Create SUCCESS Thread ID: 15124

# 3:23:23,6684710 allocator\_test.exe 19824 RegSetInfoKey HKLM\System\CurrentControlSet\Control\Session Manager SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6686147 allocator\_test.exe 19824 Thread Create SUCCESS Thread ID: 18160

# 3:23:23,6702249 allocator\_test.exe 19824 CreateFile C:\Program Files (x86)\Common Files\Oracle\Java\java8path\_target\_406656\libstdc++-6.dll REPARSE Desired Access: Read Attributes, Disposition: Open, Options: Open Reparse Point, Attributes: n/a, ShareMode: Read, Write, Delete, AllocationSize: n/a, OpenResult: <unknown>

# 3:23:23,6705524 allocator\_test.exe 19824 CreateFile C:\Program Files (x86)\Common Files\Oracle\Java\java8path\_target\_406656\libgcc\_s\_dw2-1.dll REPARSE Desired Access: Read Attributes, Disposition: Open, Options: Open Reparse Point, Attributes: n/a, ShareMode: Read, Write, Delete, AllocationSize: n/a, OpenResult: <unknown>

# 3:23:23,6707177 allocator\_test.exe 19824 CreateFile C:\Program Files (x86)\Common Files\Oracle\Java\javapath\libstdc++-6.dll PATH NOT FOUND Desired Access: Read Attributes, Disposition: Open, Options: Open Reparse Point, Attributes: n/a, ShareMode: Read, Write, Delete, AllocationSize: n/a

# 3:23:23,6709054 allocator\_test.exe 19824 CreateFile C:\Program Files (x86)\Common Files\Oracle\Java\javapath\libgcc\_s\_dw2-1.dll PATH NOT FOUND Desired Access: Read Attributes, Disposition: Open, Options: Open Reparse Point, Attributes: n/a, ShareMode: Read, Write, Delete, AllocationSize: n/a

# 3:23:23,6717545 allocator\_test.exe 19824 CreateFile C:\WINDOWS\SysWOW64\OpenSSH\libstdc++-6.dll PATH NOT FOUND Desired Access: Read Attributes, Disposition: Open, Options: Open Reparse Point, Attributes: n/a, ShareMode: Read, Write, Delete, AllocationSize: n/a

# 3:23:23,6718506 allocator\_test.exe 19824 QueryOpen D:\MinGW\bin\libstdc++-6.dll SUCCESS CreationTime: 04.03.2025 21:50:58, LastAccessTime: 11.03.2025 3:19:34, LastWriteTime: 30.05.2017 0:00:41, ChangeTime: 04.03.2025 21:50:58, AllocationSize: 1 511 424, EndOfFile: 1 508 122, FileAttributes: A

# 3:23:23,6719115 allocator\_test.exe 19824 CreateFile D:\MinGW\bin\libstdc++-6.dll SUCCESS Desired Access: Read Data/List Directory, Execute/Traverse, Synchronize, Disposition: Open, Options: Synchronous IO Non-Alert, Non-Directory File, Attributes: n/a, ShareMode: Read, Delete, AllocationSize: n/a, OpenResult: Opened

# 3:23:23,6719696 allocator\_test.exe 19824 CreateFileMapping D:\MinGW\bin\libstdc++-6.dll FILE LOCKED WITH ONLY READERS SyncType: SyncTypeCreateSection, PageProtection: PAGE\_EXECUTE\_READ|PAGE\_NOCACHE

# 3:23:23,6719961 allocator\_test.exe 19824 CreateFileMapping D:\MinGW\bin\libstdc++-6.dll SUCCESS SyncType: SyncTypeOther

# 3:23:23,6720137 allocator\_test.exe 19824 CreateFile C:\WINDOWS\SysWOW64\OpenSSH\libgcc\_s\_dw2-1.dll PATH NOT FOUND Desired Access: Read Attributes, Disposition: Open, Options: Open Reparse Point, Attributes: n/a, ShareMode: Read, Write, Delete, AllocationSize: n/a

# 3:23:23,6720939 allocator\_test.exe 19824 Load Image D:\MinGW\bin\libstdc++-6.dll SUCCESS Image Base: 0x6fe40000, Image Size: 0x174000

# 3:23:23,6721339 allocator\_test.exe 19824 QueryOpen D:\MinGW\bin\libgcc\_s\_dw2-1.dll SUCCESS CreationTime: 04.03.2025 21:50:47, LastAccessTime: 11.03.2025 3:23:17, LastWriteTime: 30.05.2017 0:00:44, ChangeTime: 04.03.2025 21:50:47, AllocationSize: 942 080, EndOfFile: 938 157, FileAttributes: A

# 3:23:23,6722013 allocator\_test.exe 19824 CloseFile D:\MinGW\bin\libstdc++-6.dll SUCCESS

# 3:23:23,6722970 allocator\_test.exe 19824 CreateFile D:\MinGW\bin\libgcc\_s\_dw2-1.dll SUCCESS Desired Access: Read Data/List Directory, Execute/Traverse, Synchronize, Disposition: Open, Options: Synchronous IO Non-Alert, Non-Directory File, Attributes: n/a, ShareMode: Read, Delete, AllocationSize: n/a, OpenResult: Opened

# 3:23:23,6723505 allocator\_test.exe 19824 CreateFileMapping D:\MinGW\bin\libgcc\_s\_dw2-1.dll FILE LOCKED WITH ONLY READERS SyncType: SyncTypeCreateSection, PageProtection: PAGE\_EXECUTE\_READ|PAGE\_NOCACHE

# 3:23:23,6723850 allocator\_test.exe 19824 CreateFileMapping D:\MinGW\bin\libgcc\_s\_dw2-1.dll SUCCESS SyncType: SyncTypeOther

# 3:23:23,6724904 allocator\_test.exe 19824 Load Image D:\MinGW\bin\libgcc\_s\_dw2-1.dll SUCCESS Image Base: 0x6eb40000, Image Size: 0xdd000

# 3:23:23,6725704 allocator\_test.exe 19824 CloseFile D:\MinGW\bin\libgcc\_s\_dw2-1.dll SUCCESS

# 3:23:23,6737233 allocator\_test.exe 19824 CreateFile C:\Program Files (x86)\Common Files\Oracle\Java\java8path\_target\_406656\libgcc\_s\_dw2-1.dll REPARSE Desired Access: Read Attributes, Disposition: Open, Options: Open Reparse Point, Attributes: n/a, ShareMode: Read, Write, Delete, AllocationSize: n/a, OpenResult: <unknown>

# 3:23:23,6740704 allocator\_test.exe 19824 CreateFile C:\Program Files (x86)\Common Files\Oracle\Java\javapath\libgcc\_s\_dw2-1.dll PATH NOT FOUND Desired Access: Read Attributes, Disposition: Open, Options: Open Reparse Point, Attributes: n/a, ShareMode: Read, Write, Delete, AllocationSize: n/a

# 3:23:23,6750958 allocator\_test.exe 19824 CreateFile C:\WINDOWS\SysWOW64\OpenSSH\libgcc\_s\_dw2-1.dll PATH NOT FOUND Desired Access: Read Attributes, Disposition: Open, Options: Open Reparse Point, Attributes: n/a, ShareMode: Read, Write, Delete, AllocationSize: n/a

# 3:23:23,6751915 allocator\_test.exe 19824 QueryOpen D:\MinGW\bin\libgcc\_s\_dw2-1.dll SUCCESS CreationTime: 04.03.2025 21:50:47, LastAccessTime: 11.03.2025 3:23:23, LastWriteTime: 30.05.2017 0:00:44, ChangeTime: 04.03.2025 21:50:47, AllocationSize: 942 080, EndOfFile: 938 157, FileAttributes: A

# 3:23:23,6755211 allocator\_test.exe 19824 RegSetInfoKey HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6755514 allocator\_test.exe 19824 RegQueryKey HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options SUCCESS Query: HandleTags, HandleTags: 0x400

# 3:23:23,6756426 allocator\_test.exe 19824 RegQueryKey HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options SUCCESS Query: HandleTags, HandleTags: 0x400

# 3:23:23,6757164 allocator\_test.exe 19824 RegQueryKey HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options SUCCESS Query: HandleTags, HandleTags: 0x400

# 3:23:23,6760329 allocator\_test.exe 19824 RegSetInfoKey HKLM\System\CurrentControlSet\Control\Nls\Sorting\Versions SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6760458 allocator\_test.exe 19824 RegQueryValue HKLM\System\CurrentControlSet\Control\Nls\Sorting\Versions\(Default) SUCCESS Type: REG\_SZ, Length: 18, Data: 00060403

# 3:23:23,6760667 allocator\_test.exe 19824 RegQueryValue HKLM\System\CurrentControlSet\Control\Nls\Sorting\Versions\000604xx SUCCESS Type: REG\_SZ, Length: 26, Data: kernel32.dll

# 3:23:23,6763493 allocator\_test.exe 19824 RegSetInfoKey HKLM\System\CurrentControlSet\Control\Session Manager SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6768417 allocator\_test.exe 19824 RegSetInfoKey HKLM\System\CurrentControlSet\Control\Nls\CustomLocale SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6769852 allocator\_test.exe 19824 RegSetInfoKey HKLM\System\CurrentControlSet\Control\Nls\ExtendedLocale SUCCESS KeySetInformationClass: KeySetHandleTagsInformation, Length: 0

# 3:23:23,6772518 allocator\_test.exe 19824 CreateFile C:\Users\kvv22 SUCCESS Desired Access: Read Data/List Directory, Synchronize, Disposition: Open, Options: Directory, Synchronous IO Non-Alert, Attributes: n/a, ShareMode: Read, Write, Delete, AllocationSize: n/a, OpenResult: Opened

# 3:23:23,6773128 allocator\_test.exe 19824 QueryDirectory C:\Users\kvv22\\* SUCCESS FileInformationClass: FileBothDirectoryInformation, Filter: \*, 2: .

# 3:23:23,6773583 allocator\_test.exe 19824 QueryDirectory C:\Users\kvv22 SUCCESS FileInformationClass: FileBothDirectoryInformation, 1: .., 2: .cache, 3: .gitconfig, 4: .gnupg, 5: .lesshst, 6: .matplotlib

# 3:23:23,6774734 allocator\_test.exe 19824 QueryDirectory C:\Users\kvv22 SUCCESS FileInformationClass: FileBothDirectoryInformation, 1: ntuser.dat.LOG2, 2: NTUSER.DAT{0bca9da2-35ab-11ef-b835-edea36378802}.TxR.0.regtrans-ms, 3: NTUSER.DAT{0bca9da2-35ab-11ef-b835-edea36378802}.TxR.1.regtrans-ms, 4: NTUSER.DAT{0bca9da2-35ab-11ef-b835-edea36378802}.TxR.2.regtrans-ms, 5: NTUSER.DAT{0bca9da2-35ab-11ef-b835-edea36378802}.TxR.blf, 6: NTUSER.DAT{0bca9da3-35ab-11ef-b835-edea36378802}.TM.blf

# 3:23:23,6775500 allocator\_test.exe 19824 QueryDirectory C:\Users\kvv22 NO MORE FILES FileInformationClass: FileBothDirectoryInformation

# 3:23:23,6775919 allocator\_test.exe 19824 CloseFile C:\Users\kvv22 SUCCESS

# 3:23:23,7152072 allocator\_test.exe 19824 Thread Exit SUCCESS Thread ID: 15124, User Time: 0.0000000, Kernel Time: 0.0000000

# 3:23:23,7152085 allocator\_test.exe 19824 Thread Exit SUCCESS Thread ID: 20268, User Time: 0.0000000, Kernel Time: 0.0000000

# 3:23:23,7152092 allocator\_test.exe 19824 Thread Exit SUCCESS Thread ID: 18160, User Time: 0.0000000, Kernel Time: 0.0000000

# 3:23:23,7153539 allocator\_test.exe 19824 Thread Exit SUCCESS Thread ID: 1904, User Time: 0.0000000, Kernel Time: 0.0312500

# 3:23:23,7159531 allocator\_test.exe 19824 Process Exit SUCCESS Exit Status: 0, User Time: 0.0000000 seconds, Kernel Time: 0.0312500 seconds, Private Bytes: 1 048 576, Peak Private Bytes: 98 131 968, Working Set: 5 287 936, Peak Working Set: 5 287 936

# 3:23:23,7160124 allocator\_test.exe 19824 RegQueryValue HKLM\System\CurrentControlSet\Services\bam\State\UserSettings\S-1-5-21-4029382104-2437129904-1201212655-1003\\Device\HarddiskVolume3\Users\kvv22\allocator\_test.exe SUCCESS Type: REG\_BINARY, Length: 24, Data: 3B C7 DE CC 1B 92 DB 01 00 00 00 00 00 00 00 00

# 3:23:23,7160335 allocator\_test.exe 19824 RegSetValue HKLM\System\CurrentControlSet\Services\bam\State\UserSettings\S-1-5-21-4029382104-2437129904-1201212655-1003\\Device\HarddiskVolume3\Users\kvv22\allocator\_test.exe SUCCESS Type: REG\_BINARY, Length: 24, Data: 2A 1B E9 CC 1B 92 DB 01 00 00 00 00 00 00 00 00

# 3:23:23,7161799 allocator\_test.exe 19824 CloseFile C:\Windows SUCCESS

# 3:23:23,7162815 allocator\_test.exe 19824 CloseFile C:\Users\kvv22 SUCCESS

# Сравнение:

|  |  |  |
| --- | --- | --- |
| Критерий | Списки свободных блоков | Алгоритм Buddy Memory Allocation |
| Фактор использования | Хороший, но возможна фрагментация | Высокий, минимизируется внутренняя фрагментация |
| Скорость выделения | Быстрая, зависит от поиска | Быстрая, фиксированная сложность O(log n) |
| Скорость освобождения | Медленная, требует перебора | Быстрая, упрощённая структура данных |
| Простота использования | Сложная логика поиска/сортировки | Проще благодаря бинарному дереву |

# Вывод

# В ходе выполнения лабораторной работы были реализованы и протестированы два метода управления памятью: списки свободных блоков и алгоритм Buddy Memory Allocation. Тестирование показало, что оба метода обладают своими преимуществами и недостатками в зависимости от характера выполняемых операций. Полученные результаты могут быть использованы для оптимизации процессов управления памятью в реальных приложениях.