МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РФ

федеральное государственное бюджетное образовательное учреждение высшего образования

**«Вологодский государственный университет»**

**Институт математики, естественных и компьютерных наук**

**Информатика и вычислительная техника**

**ОТЧЁТ ПО ЛАБОРАТОРНОЙ РАБОТЕ №7**

**«Принципы работы кэш-памяти»**

Дисциплина: «ЭВМ и периферийные устройства»

Направление подготовки: 09.03.01. Информатика и вычислительная техника

|  |  |
| --- | --- |
| Руководитель | Павлов В. В. |
| Выполнили студенты | Пчелкина О.С. |
| Группа, курс | 4Б09 ВМ-31 3 курс |
| Дата сдачи |  |
| Дата защиты | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  *(подпись преподавателя)* |

Вологда

2022 г.

**Задание:**

В качестве задания предлагается некоторая короткая "программа",

которую необходимо выполнить с подключенной кэш-памятью (размером 4

и 8 ячеек) в шаговом режиме для следующих двух вариантов алгоритмов за-

мещения

***Вариант 6:***



|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SUB 10 | POP R3 | PUSH R3 | CALL 006 | POP R3 | CALL 006 | RET | WR -@R3 | CALL 006 | ADD @R1+ | PUSH R6 | RET |

**Задание 1**

Код программы:

SUB 10

POP R3

PUSH R3

CALL 006

POP R3

CALL 006

RET

WR -@R3

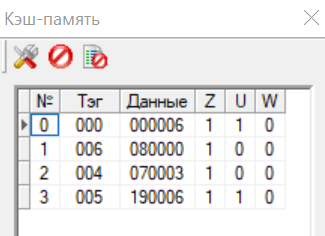
CALL 006

ADD @R1+

PUSH R6

RET

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **PC** | **Мнемокод** | **№** | **Тэг** | **Данные** | **Z** | **U** | **W** |
| 000 | SUB 10 | 0 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 1 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 2 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 3 | 000 | 000000 | 0 | 0 | 0 |
| 001 | POP R3 | 0 | 000 | 240010 | 1 | 1 | 0 |
|  |  | 1 | 010 | 060006 | 1 | 1 | 0 |
|  |  | 2 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 3 | 000 | 000000 | 0 | 0 | 0 |
| 002 | PUSH R3 | 0 | 000 | 240010 | 1 | 1 | 0 |
|  |  | 1 | 010 | 060006 | 1 | 1 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 1 | 0 |
|  |  | 3 | 000 | 000000 | 0 | 0 | 0 |
| 003 | CALL 6 | 0 | 000 | 240010 | 1 | 1 | 0 |
|  |  | 1 | 010 | 060006 | 1 | 0 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 0 | 0 |
|  |  | 3 | 002 | 060003 | 1 | 0 | 0 |
| 006 | RET | 0 | 003 | 190006 | 1 | 1 | 0 |
|  |  | 1 | 999 | 000004 | 1 | 1 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 0 | 0 |
|  |  | 3 | 002 | 060003 | 1 | 0 | 0 |
| 004 | POP R3 | 0 | 003 | 190006 | 1 | 1 | 0 |
|  |  | 1 | 999 | 000004 | 1 | 1 | 0 |
|  |  | 2 | 006 | 080000 | 1 | 1 | 0 |
|  |  | 3 | 002 | 060003 | 1 | 0 | 0 |
| 005 | CALL 006 | 0 | 000 | 240010 | 1 | 1 | 0 |
|  |  | 1 | 999 | 000004 | 1 | 0 | 0 |
|  |  | 2 | 006 | 080000 | 1 | 0 | 0 |
|  |  | 3 | 004 | 070003 | 1 | 0 | 0 |
| 006 | RET | 0 | 000 | 000006 | 1 | 1 | 0 |
|  |  | 1 | 005 | 190006 | 1 | 1 | 0 |
|  |  | 2 | 006 | 080000 | 1 | 0 | 0 |
|  |  | 3 | 004 | 070003 | 1 | 0 | 0 |
| 003 | CALL 6 | 0 | 000 | 000006 | 1 | 1 | 0 |
|  |  | 1 | 005 | 190006 | 1 | 1 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 1 | 0 |
|  |  | 3 | 004 | 070003 | 1 | 0 | 0 |
| 006 | RET | 0 | 000 | 000006 | 1 | 0 | 0 |
|  |  | 1 | 005 | 190006 | 1 | 0 | 0 |
|  |  | 2 | 001 | 000004 | 1 | 1 | 0 |
|  |  | 3 | 003 | 190006 | 1 | 0 | 0 |
| 004 | POP R3 | 0 | 006 | 080000 | 1 | 1 | 0 |
|  |  | 1 | 005 | 190006 | 1 | 0 | 0 |
|  |  | 2 | 001 | 000004 | 1 | 1 | 0 |
|  |  | 3 | 003 | 190006 | 1 | 0 | 0 |
| 005 | CALL 6 | 0 | 006 | 080000 | 1 | 1 | 0 |
|  |  | 1 | 004 | 070003 | 1 | 1 | 0 |
|  |  | 2 | 002 | 060003 | 1 | 1 | 0 |
|  |  | 3 | 003 | 190006 | 1 | 0 | 0 |
| 006 | RET | 0 | 006 | 080000 | 1 | 0 | 0 |
|  |  | 1 | 004 | 070003 | 1 | 0 | 0 |
|  |  | 2 | 002 | 000006 | 1 | 1 | 0 |
|  |  | 3 | 005 | 190006 | 1 | 0 | 0 |

******

**Задание 2**

Для одной из команд записи (WR) перейти в режим **Такт** и отметить, в каких микрокомандах происходит изменение кэш-памяти.

WR R2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Мнемокод** | **№** | **Тэг** | **Данные** | **Z** | **U** | **W** |
| 00 | MAR := PC | 0 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 1 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 2 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 3 | 000 | 000000 | 0 | 0 | 0 |
| 01 | MRd | 0 | 001 | 000004 | 1 | 0 | 0 |
|  |  | 1 | 002 | 000006 | 1 | 1 | 0 |
|  |  | 2 | 003 | 190006 | 1 | 1 | 0 |
|  |  | 3 | 006 | 000004 | 1 | 1 | 0 |
| 02 | CR := MDR | 0 | 007 | 326003 | 1 | 0 | 0 |
|  |  | 1 | 002 | 000006 | 1 | 0 | 0 |
|  |  | 2 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 3 | 006 | 000004 | 1 | 0 | 0 |
| 03 | PC := PC+1 | 0 | 007 | 326003 | 1 | 0 | 0 |
|  |  | 1 | 002 | 000006 | 1 | 0 | 0 |
|  |  | 2 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 3 | 006 | 000004 | 1 | 0 | 0 |
| 04 | RAR := CR5 | 007 | 007 | 326003 | 1 | 0 | 0 |
|  |  | 002 | 002 | 000006 | 1 | 0 | 0 |
|  |  | 003 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 006 | 006 | 000004 | 1 | 0 | 0 |
| 05 | Dec\_GR | 007 | 007 | 326003 | 1 | 0 | 0 |
|  |  | 002 | 002 | 000006 | 1 | 0 | 0 |
|  |  | 003 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 006 | 006 | 000004 | 1 | 0 | 0 |
| 06 | RRd | 0 | 007 | 326003 | 1 | 0 | 0 |
|  |  | 1 | 002 | 000006 | 1 | 0 | 0 |
|  |  | 2 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 3 | 006 | 000004 | 1 | 0 | 0 |
| 07 | RA:=RDR | 0 | 007 | 326003 | 1 | 0 | 0 |
|  |  | 1 | 002 | 000006 | 1 | 0 | 0 |
|  |  | 2 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 3 | 006 | 000004 | 1 | 0 | 0 |
| 08 | MAR:=RA | 0 | 007 | 326003 | 1 | 0 | 0 |
|  |  | 1 | 002 | 000006 | 1 | 0 | 0 |
|  |  | 2 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 3 | 006 | 000004 | 1 | 0 | 0 |
| 09 | MDR:=Acc | 0 | 007 | 326003 | 1 | 0 | 0 |
|  |  | 1 | 002 | 000006 | 1 | 0 | 0 |
|  |  | 2 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 3 | 006 | 000004 | 1 | 0 | 0 |
| 10 | MWr | 0 | 007 | 326003 | 1 | 0 | 0 |
|  |  | 1 | 002 | 000006 | 1 | 0 | 0 |
|  |  | 2 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 3 | 006 | 000004 | 1 | 0 | 0 |
| 11 | END\_COMMAND | 0 | 007 | 326003 | 1 | 0 | 0 |
|  |  | 1 | 002 | 000006 | 1 | 0 | 0 |
|  |  | 2 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 3 | 006 | 000004 | 1 | 0 | 0 |

**Задание 3**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **PC** | **Мнемокод** | **№** | **Тэг** | **Данные** | **Z** | **U** | **W** |
| 000 | SUB 10 | 0 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 1 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 2 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 3 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 4 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 5 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 6 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 7 | 000 | 000000 | 0 | 0 | 0 |
| 001 | POP R3 | 0 | 000 | 240010 | 1 | 1 | 0 |
|  |  | 1 | 010 | 060006 | 1 | 1 | 0 |
|  |  | 2 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 3 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 4 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 5 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 6 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 7 | 000 | 000000 | 0 | 0 | 0 |
| 002 | PUSH R3 | 0 | 000 | 240010 | 1 | 1 | 0 |
|  |  | 1 | 010 | 060006 | 1 | 1 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 1 | 0 |
|  |  | 3 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 4 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 5 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 6 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 7 | 000 | 000000 | 0 | 0 | 0 |
| 003 | CALL 006 | 0 | 000 | 240010 | 1 | 1 | 1 |
|  |  | 1 | 010 | 060006 | 1 | 1 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 1 | 0 |
|  |  | 3 | 002 | 060003 | 1 | 1 | 0 |
|  |  | 4 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 5 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 6 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 7 | 000 | 000000 | 0 | 0 | 0 |
| 006 | RET | 0 | 000 | 240010 | 1 | 1 | 1 |
|  |  | 1 | 010 | 060006 | 1 | 1 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 1 | 0 |
|  |  | 3 | 002 | 060003 | 1 | 1 | 0 |
|  |  | 4 | 003 | 190006 | 1 | 1 | 0 |
|  |  | 5 | 999 | 000004 | 1 | 1 | 0 |
|  |  | 6 | 000 | 000000 | 0 | 0 | 0 |
|  |  | 7 | 000 | 000000 | 0 | 0 | 0 |
| 004 | POP R3 | 0 | 000 | 240010 | 1 | 1 | 1 |
|  |  | 1 | 010 | 060006 | 1 | 1 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 1 | 0 |
|  |  | 3 | 002 | 060003 | 1 | 1 | 0 |
|  |  | 4 | 003 | 190006 | 1 | 1 | 0 |
|  |  | 5 | 999 | 000004 | 1 | 1 | 0 |
|  |  | 6 | 006 | 080000 | 1 | 1 | 0 |
|  |  | 7 | 000 | 000000 | 0 | 0 | 0 |
| 005 | CALL 006 | 0 | 000 | 240010 | 1 | 1 | 1 |
|  |  | 1 | 010 | 060006 | 1 | 0 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 0 | 0 |
|  |  | 3 | 002 | 060003 | 1 | 0 | 0 |
|  |  | 4 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 5 | 999 | 000004 | 1 | 0 | 0 |
|  |  | 6 | 006 | 080000 | 1 | 0 | 0 |
|  |  | 7 | 004 | 070003 | 1 | 0 | 0 |
| 006 | RET | 0 | 000 | 000006 | 1 | 1 | 1 |
|  |  | 1 | 010 | 060006 | 1 | 0 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 0 | 0 |
|  |  | 3 | 002 | 060003 | 1 | 0 | 0 |
|  |  | 4 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 5 | 999 | 000004 | 1 | 0 | 0 |
|  |  | 6 | 006 | 080000 | 1 | 0 | 0 |
|  |  | 7 | 005 | 070003 | 1 | 1 | 0 |
| 006 | RET | 0 | 000 | 000006 | 1 | 1 | 1 |
|  |  | 1 | 010 | 060006 | 1 | 0 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 0 | 0 |
|  |  | 3 | 002 | 060003 | 1 | 0 | 0 |
|  |  | 4 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 5 | 999 | 000004 | 1 | 0 | 0 |
|  |  | 6 | 006 | 080000 | 1 | 1 | 0 |
|  |  | 7 | 005 | 190006 | 1 | 1 | 0 |
| 003 | CALL 006 | 0 | 000 | 000006 | 1 | 1 | 1 |
|  |  | 1 | 010 | 060006 | 1 | 0 | 0 |
|  |  | 2 | 001 | 070003 | 1 | 1 | 0 |
|  |  | 3 | 002 | 060003 | 1 | 0 | 0 |
|  |  | 4 | 003 | 190006 | 1 | 0 | 0 |
|  |  | 5 | 999 | 000004 | 1 | 0 | 0 |
|  |  | 6 | 006 | 080000 | 1 | 1 | 0 |
|  |  | 7 | 005 | 190006 | 1 | 1 | 0 |
| 006 | RET | 0 | 000 | 000006 | 1 | 1 | 1 |
|  |  | 1 | 010 | 060006 | 1 | 0 | 0 |
|  |  | 2 | 001 | 000004 | 1 | 1 | 1 |
|  |  | 3 | 002 | 060003 | 1 | 0 | 0 |
|  |  | 4 | 003 | 190006 | 1 | 1 | 0 |
|  |  | 5 | 999 | 000004 | 1 | 0 | 0 |
|  |  | 6 | 006 | 080000 | 1 | 1 | 0 |
|  |  | 7 | 005 | 190006 | 1 | 1 | 0 |