Operating Systems
CSCI 5806

Spring Semester 2021 — CRN 21176

Term Project — Step 2 — Disk Partition Access

Target completion date: Monday, February 15, 2021

Goals

- Provide the five basic file I/O functions to access disk space inside a disk partition, which is contained in a VDI file.
- Create a structure or class to contain the data necessary to implement the five functions.

Details

As with the lower-level VDI file, you'll want to set up a basic structure or class to hold the data necessary to work with partitions. The necessary data can take one of two forms — either a pointer to an opened VDI file and a partition table entry, or the VDI file pointer, the start location of the partition within the disk and the size of the partition in bytes.
Pro tip: I use the latter option, you only have to do the calculations once.

Wikipedia has a good article on Master Boot Records (MBRs) at https://en.wikipedia.org/wiki/Master_boot_record; it has all of the information you need to extract the necessary data for this step.

In addition to the structure, you'll need to implement the five basic file I/O functions:

- **`struct PartitionFile *partitionOpen(struct VDIFile *,struct PartitionEntry)`**
  Combine the open VDI file and the given partition into a single structure and return a pointer to that structure.
- **`void partitionClose(struct PartitionFile *f)`**
  Close the file whose pointer is given. Deallocate any dynamically created memory regions.
- **`ssize_t partitionRead(struct PartitionFile *f,void *buf,size_t count)`**
  Operates the same as **`vdiRead()`**. Restrict **`count`** so that it does not read beyond the end of the partition.
- **`ssize_t partitionWrite(struct PartitionFile *f,void *buf,size_t count)`**
  Operates the same as **`vdiWrite()`**. Restrict **`count`** so that it does not write beyond the end of the partition.
- **`off_t partitionSeek(struct PartitionFile *f,off_t offset,int anchor)`**
  Operates the same as **`vdiSeek()`**. Restrict the function so that the cursor remains unchanged if a location outside the partition is requested.

If you are using a class, then the `VDIFile *` parameter is omitted.

You should also write a function that takes a pointer to a VDIFile and an array of PartitionEntry as parameters and fills the array with the disk's partition table. The function simply needs to set the cursor to offset `446` and read `64` bytes into the table.

Finally, write a function that takes a PartitionEntry structure and displays its fields in an easy-to-read manner. Again, your exact format may differ somewhat from my example.

▸*Example 1*

This is the output from my step 2 program, on the dynamic VDI file with 1KB blocks. It shows the four entries in the partition table. It then reads a 1KB block from the disk, starting at an offset of 1024. This is displayed using the **`displayBuffer(,)`** function.

Spoiler alert: That 1KB block is called the *superblock*, and it's *really* important, so it's a critical check here that your program is reading the same bytes you're seeing in this output.

```
Partition 1
Status: Inactive
First sector CHS: 0-32-33
Last sector CHS: 16-81-1
Partition type: 83 linux native
First LBA sector: 2048
LBA sector count: 260096

Partition 2
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 3
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 4
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Offset: 0x400
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-------------------------------------------------+  +----------------+
00|00 7f 00 00 00 fc 01 00 66 19 00 00 3b d6 01 00|00|        f   ;   |
10|f4 7e 00 00 01 00 00 00 00 00 00 00 00 00 00 00|10| ~              |
20|00 20 00 00 00 20 00 00 f0 07 00 00 db ea bc 56|20|               V|
30|19 eb bc 56 03 00 ff ff 53 ef 01 00 01 00 00 00|30|   V    S       |
40|9a bb ba 56 00 00 00 00 00 00 00 00 01 00 00 00|40|   V            |
50|00 00 00 00 0b 00 00 00 80 00 00 00 38 00 00 00|50|           8    |
60|02 00 00 00 01 00 00 00 71 2b 0f f6 04 66 4a a7|60|        q+   fJ |
70|86 c4 5d b7 72 22 07 09 00 00 00 00 00 00 00 00|70|  ] r"          |
80|00 00 00 00 00 00 00 00 2f 6d 65 64 69 61 2f 62|80|        /media/b|
90|6f 62 2f 37 31 32 62 30 66 66 36 2d 30 34 36 36|90|ob/712b0ff6-0466|
a0|2d 34 61 61 37 2d 38 36 63 34 2d 35 64 62 37 37|a0|-4aa7-86c4-5db77|
```

```
b0|32 32 32 30 37 30 39 00 00 00 00 00 00 00 00 00|b0|2220709         |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 2d 98 fc 1b|e0|            -   |
f0|11 69 47 40 93 c8 52 24 9c 57 46 c9 01 00 00 00|f0| iG@  R$ WF     |
  +-----------------------------------------------+  +----------------+

Offset: 0x500
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|0c 00 00 00 00 00 00 00 9a bb ba 56 00 00 00 00|00|           V    |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 b8 0f 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+

Offset: 0x600
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+

Offset: 0x700
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
```

```
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+
```

▸*Example 2*

Same output from the fixed-allocation VDI file with 1KB block size.

```
Partition 1
Status: Inactive
First sector CHS: 0-32-33
Last sector CHS: 16-81-1
Partition type: 83 linux native
First LBA sector: 2048
LBA sector count: 260096

Partition 2
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 3
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 4
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Offset: 0x400
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
```

```
  +-------------------------------------------------+  +----------------+
00|00 7f 00 00 00 fc 01 00 66 19 00 00 ef 53 00 00|00|        f    S  |
10|af 7d 00 00 01 00 00 00 00 00 00 00 00 00 00 00|10| }              |
20|00 20 00 00 00 20 00 00 f0 07 00 00 5f e7 a9 58|20|             _  X|
30|87 e7 a9 58 04 00 ff ff 53 ef 01 00 01 00 00 00|30|   X    S       |
40|88 bb ba 56 00 00 00 00 00 00 00 00 01 00 00 00|40|   V            |
50|00 00 00 00 0b 00 00 00 80 00 00 00 38 00 00 00|50|            8   |
60|02 00 00 00 01 00 00 00 5f 86 41 71 27 65 4b c9|60|        _ Aq'eK |
70|87 be a7 4a bb 9f 7d 28 00 00 00 00 00 00 00 00|70|   J  }(        |
80|00 00 00 00 00 00 00 00 2f 6d 65 64 69 61 2f 62|80|        /media/b|
90|6f 62 2f 35 66 38 36 34 31 37 31 2d 32 37 36 35|90|ob/5f864171-2765|
a0|2d 34 62 63 39 2d 38 37 62 65 2d 61 37 34 61 62|a0|-4bc9-87be-a74ab|
b0|62 39 66 37 64 32 38 00 64 32 38 00 00 00 00 00|b0|b9f7d28 d28     |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 b5 7f 76 83|e0|              v |
f0|7f cd 4d 67 a6 34 20 ae 2f fd b0 6b 01 00 00 00|f0|  Mg 4  /  k    |
  +-------------------------------------------------+  +----------------+

Offset: 0x500
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-------------------------------------------------+  +----------------+
00|0c 00 00 00 00 00 00 00 88 bb ba 56 00 00 00 00|00|           V    |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 44 93 01 00 00 00 00 00|70|        D       |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-------------------------------------------------+  +----------------+

Offset: 0x600
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-------------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
```

```
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+

Offset: 0x700
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f   0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+
```

▸*Example 3*

This is the program's output using the test VDI file with 4KB block size.

```
Partition 1
Status: Inactive
First sector CHS: 0-32-33
Last sector CHS: 16-81-1
Partition type: 83 linux native
First LBA sector: 2048
LBA sector count: 260096

Partition 2
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 3
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 4
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Offset: 0x400
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 7f 00 00 00 7f 00 00 59 06 00 00 f2 15 00 00|00|        Y       |
10|af 7d 00 00 00 00 00 00 02 00 00 00 02 00 00 00|10| }              |
20|00 80 00 00 00 80 00 00 00 7f 00 00 d8 ea bc 56|20|               V|
30|19 eb bc 56 03 00 ff ff 53 ef 01 00 01 00 00 00|30|   V    S       |
40|92 bb ba 56 00 00 00 00 00 00 00 00 01 00 00 00|40|   V            |
50|00 00 00 00 0b 00 00 00 80 00 00 00 38 00 00 00|50|             8   |
60|02 00 00 00 03 00 00 00 8c b4 8d bc 5c 10 4e 70|60|             \ Np|
70|a5 68 cd d0 ad 4f 12 0e 00 00 00 00 00 00 00 00|70| h   O          |
80|00 00 00 00 00 00 00 00 2f 6d 65 64 69 61 2f 62|80|        /media/b|
90|6f 62 2f 38 63 62 34 38 64 62 63 2d 35 63 31 30|90|ob/8cb48dbc-5c10|
a0|2d 34 65 37 30 2d 61 35 36 38 2d 63 64 64 30 61|a0|-4e70-a568-cdd0a|
b0|64 34 66 31 32 30 65 00 32 30 65 00 00 00 00 00|b0|d4f120e 20e     |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 07 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 05 e6 e3 aa|e0|                |
f0|bf 36 43 4a 9f c4 82 9f af f7 80 c0 01 00 00 00|f0| 6CJ            |
```

```
  +-----------------------------------------------+  +----------------+

Offset: 0x500
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|0c 00 00 00 00 00 00 00 92 bb ba 56 00 00 00 00|00|            V     |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                  |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                  |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                  |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                  |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                  |
60|01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                  |
70|00 00 00 00 00 00 00 00 38 95 01 00 00 00 00 00|70|         8        |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                  |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                  |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                  |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                  |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                  |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                  |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                  |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                  |
  +-----------------------------------------------+  +----------------+

Offset: 0x600
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                  |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                  |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                  |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                  |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                  |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                  |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                  |
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                  |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                  |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                  |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                  |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                  |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                  |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                  |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                  |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                  |
  +-----------------------------------------------+  +----------------+

Offset: 0x700
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                  |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                  |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                  |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                  |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                  |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                  |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                  |
```

```
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+
```