

Assignment 8:

File Systems

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COMP 3411 – Operating System

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Question 1

The 7 basic file attributes associated with a file in operating systems are:

1. **Name** - The symbolic file name is the only information kept in human-readable form.
2. **Identifier** - This unique tag, usually a number, identifies the file within the file system; it is the non-human-readable name for the file.
3. **Type** - This information is needed for systems that support different types of files.
4. **Location** - This information is a pointer to a device and to the location of the file on that device.
5. **Size** - The current size of the file (in bytes, words, or blocks) and possibly the maximum allowed size are included in this attribute.
6. **Protection** - Access-control information determines who can do reading, writing, executing, and so on.
7. **Timestamps and user identification** - This information may be kept for creation, last modification, and last use. These data can be useful for protection, security, and usage monitoring.

Question 2

The 8 basic file operations are:

1. **Create**
2. **Write** – at write pointer location
3. **Read** – at read pointer location
4. **Reposition within file** - seek
5. **Delete**
6. **Truncate**
7. **Open (Fi)** – search the directory structure on disk for entry Fi, and move the content of entry to memory
8. **Close (Fi)** – move the content of entry Fi in memory to directory structure on disk

Question 3

- Operating system can recognize the type of a file and then operate on the file in reasonable ways. The system uses the extension to indicate the type of the file and the type of operations that can be done on that file. Only a file with a .com, .exe, or .sh extension can be executed, for instance.
- In macOS operating system, each file has a type, such as .app (for application). Each file also has a creator attribute containing the name of the program that created it. This attribute is set by the operating system during the create() call, so its use is enforced and supported by the system.
- The UNIX system uses a magic number stored at the beginning of some binary files to indicate the type of data in the file. Likewise, it uses a text magic number at the start of text files to indicate the type of file (which shell language a script is written in) and so on. Not all files have magic numbers, so system features cannot be based solely on this.

Question 4

- Application programs also use extensions to indicate file types in which they are interested. For example, Java compilers expect source files to have a .java extension, and the Microsoft Word word processor expects its files to end with a .doc or .docx extension. These extensions are not always required, so a user may specify a file without the extension (to save typing), and the application will look for a file with the given name and the extension it expects. Because these extensions are not supported by the operating system, they can be considered “hints” to the applications that operate on them.

Question 5

- For sequential access file, information in the file is processed in order, one record after the other.
- For direct/relative access file, it is made up of fixed-length logical records that allow programs to read and write records rapidly in no particular order.

Question 6

The direct access method is based on a disk model of a file since disks allow random access to any file block. The direct access file is viewed as a numbered sequence of blocks or records. Thus, we may read block 14, then read block 53, and then write block 7. There are no restrictions on the order of reading or writing for a direct-access file.

4.1

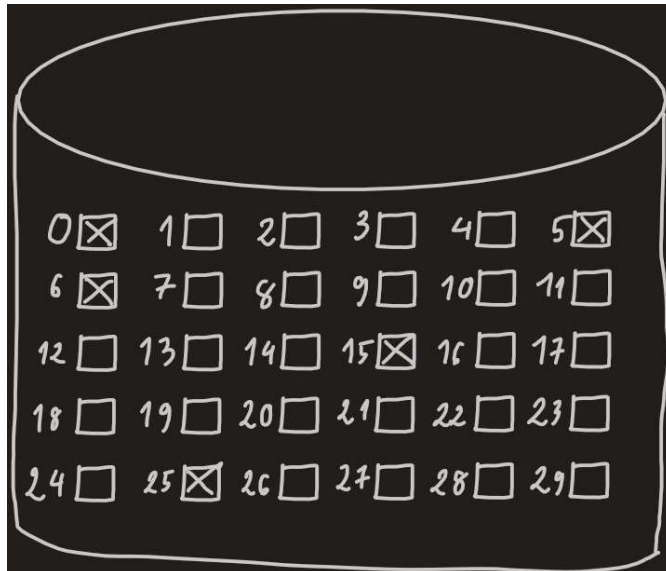
Question 7

The basic operations required on a directory in file systems are:

- **Search for a file**
- **Create a file**
- **Delete a file**
- **List a directory**
- **Rename a file**
- **Traverse the file system**

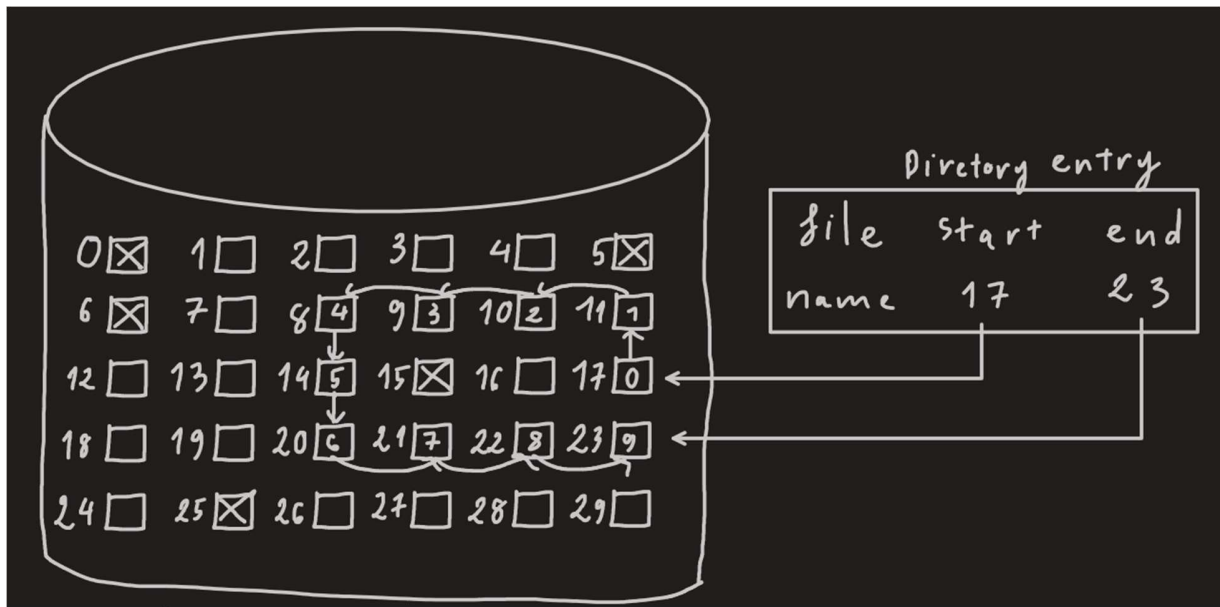
Question 8

Contiguous allocation

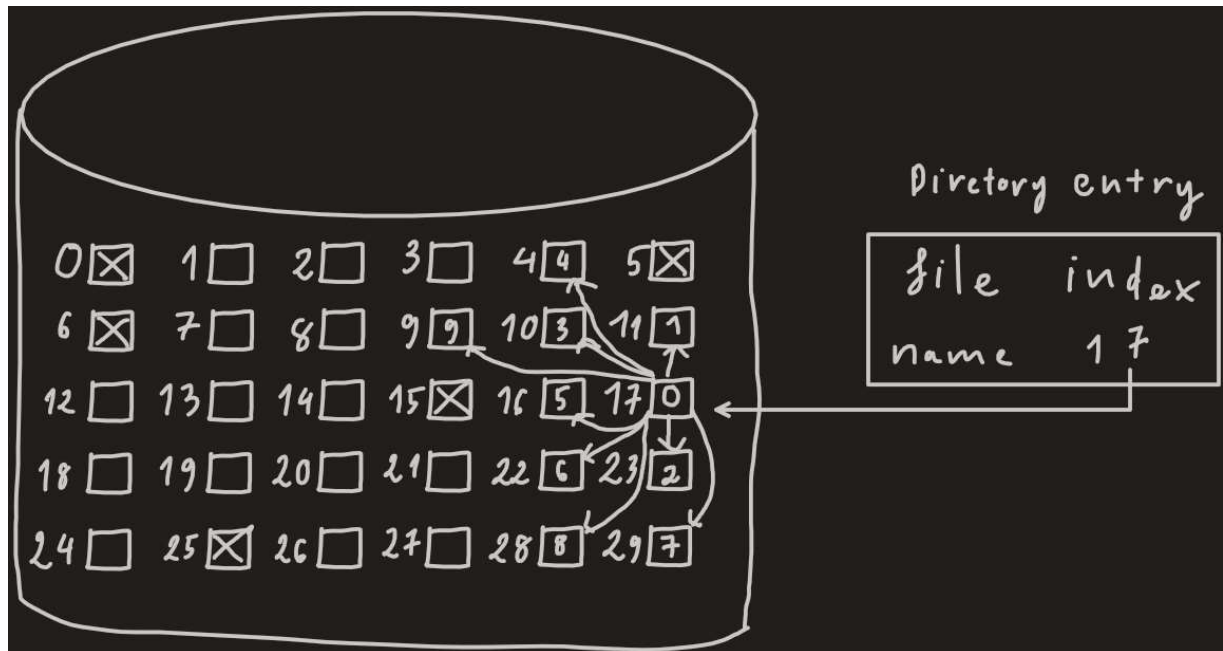


Since there are no 10 contiguous blocks of free space (the largest chain of contiguous blocks is 9 in this case), the file wouldn't be allocated at all without a preceding compaction.

Linked allocation



Indexed allocation



Index of comments

4.1 -1/2 lock size and offset