6.3.4. Associative Memory

In an associative memory any stored item can be accessed by using the contents of the item in question, generally some specified sub field, as an address. The sub field chosen to address the memory is called the key. Items stored in an associative memory can be viewed as having the two-field format.

DO YOU KNOW

Associative memories are also commonly known as Content Addressable Memories (CAMs).

Key, Data

Where KEY is the stored address and DATA is the information to be accessed. For example, if a page table of the kind shown in Figure 6.24 is placed in an associate memory, the page address can be selected as the key, while the page frame, presence bit, change bit and access rights from the data. Such a memory can then be accessed with a request such as: Read the page frame number corresponding to page address E.

An associative cache employs a tag, that is, a block address, as the key. At the start of a memory access, the incoming tag is compared simultaneously to all the tags stored in the cache's tag memory. If a match (cache hit) occurs, a match-indicating signal triggers the cache to service the requested memory access. A no-match signal identifies a cache miss, and the memory access requested is forwarded to main memory for service. A cache block containing the target address is then sent from main memory to the cache, and at the same time, a data word is sent to the CPU or transferred from CPU to the cache, in response to the original access request.

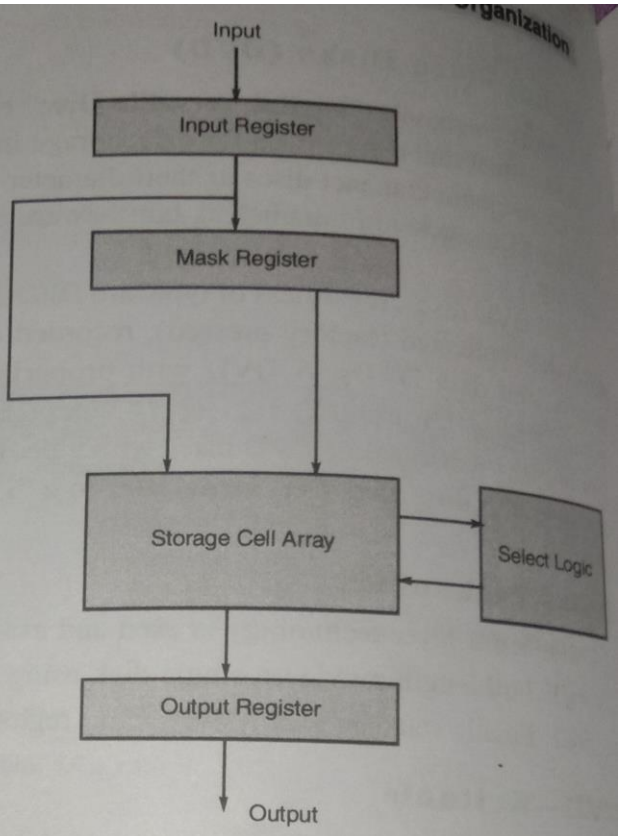

Fig. 6.24. Content Addressable Memory

Fig. 6.24 shows the general structure of an **associative memory.** Each unit of stored information is a fixed-length word. Any sub field of the word can be chosen as the key. Here the desired key is specified by *mask register*, whose contents identify the bit positions (which need not be adjacent) that define the key. The current key is compared simultaneously with all stored words; those that match the key output a match signal, which enter a select circuit, which enables the data field to be accessed. If several entries have the same key, then the select circuit, which enables the data field to be accessed. If several entries have the same key, then the select circuit determines which data field is to be read out. It can, for example, read out all matching entries in some predetermined order. Since all words in the memory are required to compare their keys with the input key simultaneously, each needs its own match circuit. The match and select circuits make associative memories much more complex and expensive than conventional memories.

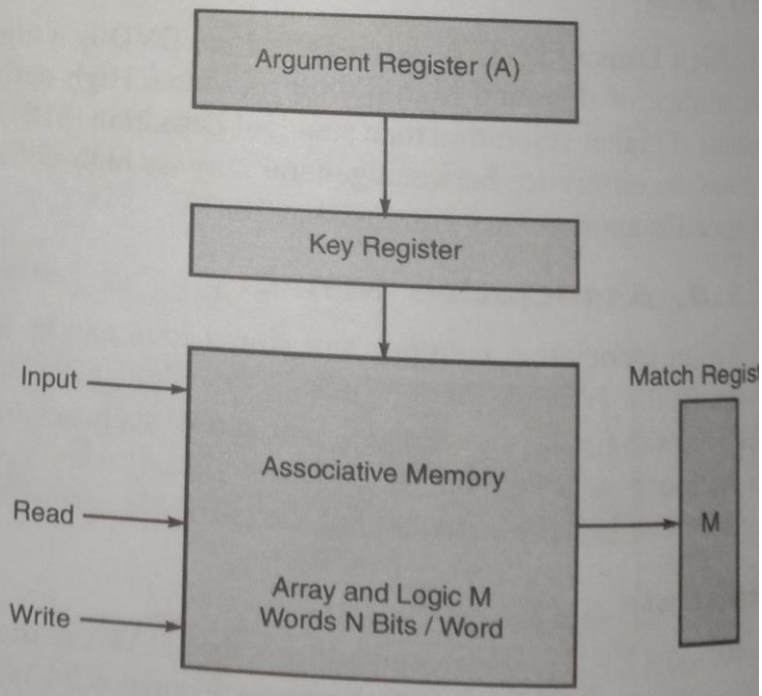

Fig. 6.25. AM Diagram

This is the type of memory where we access data by searching or matching the contents and not by address value. Accessed by the content of the data rather than by an addres
This is also called content addressable memory (CAM).

In this the data we need to search is kept in Argument register. This is of the same length as of word size. Since we have m words of n bits length we will have argument register of length n bits. Also we have M as match register which gives us the matching result in terms of those particular bits high. This is equal to the number of words in memory, so match register is of length m bits.

For example if we have to search 1011 and you have words

Like
1011
0111
1000
1100
0010
1011
0111
1011

In this we have occurrence of 1011, 3 times i.e for 1st, 6th and 8th word. Thus the value of match register will be high at 1st, 6th and 8th place else it will be low.

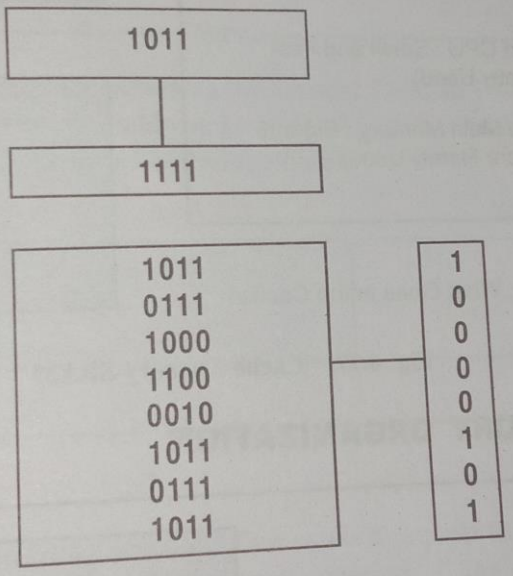

Fig. 6.26.

In this the value of key register is 1111 which represents that it is matching all the bits of argument register to every word of associative memory. In case we need to choose only some bits for checking as we want all words ending with one. The value of key register will be 0001 (as we are matching only last bit)

And the value of Match Register will be 11000111.