Example: Compute the three parameters (Word, Set/block, and Tag) for a memory system having the following specification: the main memory is 4K blocks, the cache is 128 blocks, and the block size is 16 words.

1- Direct mapping.

2- Full associative.

3- 2-way set associative.

4- 4-way set associative.

1) Direct mapping
Main memory is 4K → $2^2 * 2^{10}$ → 2^{12}
Word is 16 → 2^4
Cache is 128 → 2^7
Main memory size = number of blocks * number of line in block(word)
$\qquad = 2^{12} * 2^4$
$\qquad = 2^{16}$

16

Tag	Block	Word

Word is 4
Block is 7
16=t+7+4
T=16-11
  = 5

2) Full associative
Main memory is 4K → $2^2 * 2^{10}$ → 2^{12}
Word is 16 → 2^4
Cache is 128 → 2^7
Main memory size = number of blocks * number of line in block(word)
= $2^{12} * 2^4$
= 2^{16}

16

Tag	Word

16=t+4
T=12

3) 2-way set associative

Main memory is 4K $\rightarrow 2^2 * 2^{10} \rightarrow 2^{12}$
Word is 16 $\rightarrow 2^4$
Cache is 128 $\rightarrow 2^7$
Main memory size = number of blocks * number of line in block(word)
$= 2^{12} * 2^4$
$= 2^{16}$
Number of sets in cache = blocks in cache / way
$= 128/2$
$= 64$
$= 2^6$

16

Tag	Set	Word

Word = 4
Set = 6
Tag = 6

4) 4-way set associative

Main memory is 4K $\rightarrow 2^2 * 2^{10} \rightarrow 2^{12}$
Word is 16 $\rightarrow 2^4$
Cache is 128 $\rightarrow 2^7$
Main memory size = number of blocks * number of line in block(word)
$= 2^{12} * 2^4$
$= 2^{16}$
Number of sets in cache = blocks in cache / way
$= 128/4$
$= 32$
$= 2^5$

16

Tag	Set	Word

Word = 4
Set = 5
Tag = 7