Consider the C declarations and for loop shown below. Read the assumptions carefully. Write your answer to each of the 5 questions in the associated answer box. You must also include a brief explanation in the space provided in otder to get any marks.

int A[1024], B[1024];
int i, cksum = 0;
for (i = 0; i < 1024; i++)   cksum = cksum + A[i] * B[i];

Assume
- the variables **i** and **cksum** are allocated by the compiler in CPU general purpose registers
- the compiler assigns memory addresses to vectors **A** and **B** such that vector **B** starts immediately after the last element of vector **A**
- Data of type int is represented using **2s complement** representation in **16 bits**
- The program is run on a processor whose **direct mapped** data cache views the **32 bit memory address** as a **TAG field**, **INDEX field** and an **OFFSET field**. **(Note: There were 2 versions of the Quiz with different tag field sizes)**

Question	Version 1: 14 tag bits, 12 index bits (i.e., 6 offset bits)	Version 2: 15 tag bits, 12 index bits (i.e., 5 offset bits)
How many entries are there in the cache directory?	$2^{12} = 4096$	$2^{12} = 4096$
What is the size of the cache (in KBytes)?	Number of blocks x Block size = 2^{12} x 2^{6} Bytes = 2^{18} B = 256 KBytes	Number of blocks x Block size = 2^{12} x 2^{5} Bytes = 2^{17} B = 128 KBytes
How many elements of **A** or **B** fit into a single cache block?	Vector element size = 16 bits = 2 Bytes Block size / Vector element size = 2^{6} Bytes / 2 Bytes = 32	Vector element size = 16 bits = 2 Bytes Block size/Vector element size = 2^{5} Bytes / 2 Bytes = 16
Will the base addresses of **A** and **B** have the same cache index value?	No. If A starts at 0x0, then B starts at 0x0 + 2 * 1024 = 0x800. Cache index of A is 0, cache index of B is 0x20	No. If A starts at 0x0, then B starts at 0x0 + 2 * 1024 = 0x800. Cache index of A is 0, cache index of B is 0x40
What will the cache hit ratio be (assumng that cache initially contains no elements of A or B, and that padding is used if necessary)?	A[0] and B[0] will miss. This will be followed by hits for A[1], B[1], A[2], B[2], ..., A[31], B[31]. Thus, there will repeatedly be 2 misses followed by 62 hits for a hit ratio = 62/64	A[0] and B[0] will miss. This will be followed by hits for A[1], B[1], A[2], B[2], ..., A[15], B[16]. Thus, there will repeatedly be 2 misses followed by 30 hits for a hit ratio = 30/32