Korea Advanced Institute of Science and Technology

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**Homework 3**

1. **Problem 1**

Suppose you have a shared memory tile with dimension [32][32]. Pad a column to it and then draw an illustration showing the mapping between data elements and banks for a Kepler device in 8-byte access mode.

Assume each element of the shared memory tile is a 4-byte word and have index as Figure 1.1.



**Figure 1.1.** 2-D and 1-D data layout of the shared memory tile



**Figure 1.2.** Bank mapping before padding

From byte address in Figure 1.1, before padding each element is mapped into bank with 8-byte access mode as shown in Figure 1.2. In order to avoid bank conflict, two 4-byte word is added at the end of each row of the shared memory tile, see Figure 1.3. After padding, each 4-byte word is relocated by Figure 1.4.



**Figure 1.3.** Shared memory padding with 2 columns



**Figure 1.4.** Shared memory mapping into bank after padding

The bank mapping rule is presented as follow:

Let row[idx] is the row having index is idx.

* If idx is even and 0 ≤ idx ≤ 14, after saving row[idx], bank[idx + 16] is padd. Example: after storing row[0], bank[16] is padd and after row[2], bank[2] is padd.
* If idx is even and 16 ≤ idx ≤ 30, after row[idx] is stored, bank[idx – 16] is padd. Example: after row[16] is stored, bank[0] is padd and after row[18] is stored, bank[2] is padd.
* If idx is odd then after relocating row[idx], bank[idx] is padd, such as after row 1, bank 1 is padded then after row 3, bank 3 is padded and so on.

1. **Problem 2**