

Exercises for the book

Semantic Web Databases

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Solutions

Chapter 8 – Parallel Databases

1. a) $3 = \langle 3, 0, 0 \rangle_8$
 $h_{\langle 5, 8, 9 \rangle}(\langle 3, 0, 0 \rangle_8) = \sum_{i=0}^r (a_i * x_i) \bmod 13 = (3*5 + 0*8 + 0*9) \bmod 13 = 15 \bmod 13 = 2$
- $20 = \langle 4, 2, 0 \rangle_8$
 $h_{\langle 5, 8, 9 \rangle}(\langle 4, 2, 0 \rangle_8) = \sum_{i=0}^r (a_i * x_i) \bmod 13 = (4*5 + 2*8 + 0*9) \bmod 13 = 36 \bmod 13 = 10$
- $82 = \langle 2, 2, 1 \rangle_8$
 $h_{\langle 5, 8, 9 \rangle}(\langle 2, 2, 1 \rangle_8) = \sum_{i=0}^r (a_i * x_i) \bmod 13 = (2*5 + 2*8 + 1*9) \bmod 13 = 35 \bmod 13 = 9$

b) We look at the results for $x = 0$ and $x = 1$:

$$h_a(0) = \sum_{i=0}^r (a_i * 0) \bmod m = 0$$
$$h_a(1) = a_0 + \sum_{i=1}^r (a_i * 0) \bmod m = a_0$$

$h_a(0) \neq h_a(1)$ holds for $a_0 \neq 0$, i.e., the number of hash functions with $h_a(0) = h_a(1)$ is guaranteed $0 < |H|/m$. Therefore, this class of hash functions is not universal!

Remark: Only little changes in the definition of the classes of hash functions can cause that this class is not universal any more!

2. The best choices for 3 threads computing operand results are C, G and H, as the other operands are triple pattern operators, each result of which can be determined from one index access.