

2/19/09
 CUDA memory I

Review:

? # of operations?

scan applications.
 first order recurrence problems.

list compaction app
 example: image adaptive sampling

discussed up-sweep. → reduction with a general associative operation.
 down-sweep would be the same.

- high order recurrence:

$$x_i = \begin{cases} b_i & 0 \leq i < m \\ (x_{i-1} \times a_{i,1}) + (x_{i-2} \times a_{i,2}) + \dots + (x_{i-m} \times a_{i,m}) + b_i & m \leq i < n \end{cases}$$

let's define an vector form of $x_i \Rightarrow \vec{x}_i$

$$\vec{x}_i = [x_i, x_{i-1}, x_{i-2}, \dots, x_{i-m+1}]$$

then we can cast this problem as a first order recurrence

as:

$$\vec{x}_i = [x_i, x_{i-1}, x_{i-2}, \dots, x_{i-m+1}] \begin{bmatrix} a_{i,1} & 1 & & & \\ a_{i,2} & & 1 & & \\ \vdots & & & \ddots & \\ \vdots & & & & 1 \\ a_{i,m} & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$+ [b_i \ 0 \ 0 \ 0 \ \dots]$$

$$= \vec{x}_{i-1} \times A + \vec{B}_i$$

vector-matrix mult.

a quick look at Fibonacci sequence:

$$x_i = \begin{cases} 1 & i=0,1 \\ x_{i-1} + x_{i-2} & i \geq 2 \end{cases}$$

$$\vec{x}_i = [x_i, x_{i-1}]$$

$$A = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$$

$$\text{so: } \vec{x}_i = [x_i, x_{i-1}] \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$$

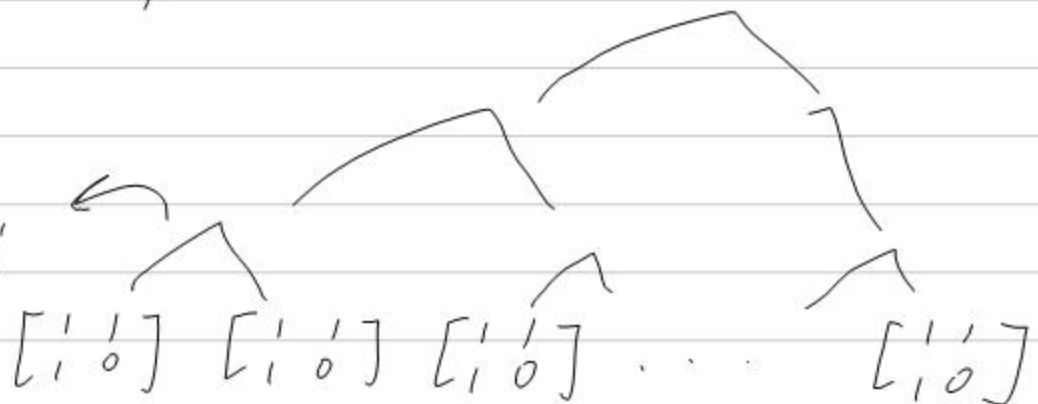
$$= \vec{x}_{i-1} \times A$$

→ no constant term.

$$\text{so in fact. } \vec{x}_i = A^i \quad i \geq 2$$

so what you do is.

matrix multiplication!



of operations ?

- segmented scan:

resets where the seg-tag is 1.

cast as a first order recurrence problem:

$$x_i = \begin{cases} b_0 & i=0 \\ (1-f) \times x_{i-1} + b_i & i \geq 1 \end{cases}$$

example: quicksort using segmented scan.

Keep each subset in its own segment.

pick pivot values and split the keys independently within each segment.