并行与分布式计算导论 作业 4

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1. a) 二叉树 One-to-all Broadcast.

```
def One-to-all-Bcast (tree):
    if tree.root.leftchild:
        sendmessageto (tree.root.leftchild)
        One-to-all-Bcast (tree.root.leftchild) // no-wait.
    if tree.root.rightchild
        send messageto (tree.root.rightchild).
        One-to-all-Bcast (tree.root.rightchild) // no-wait.
```

b) 超立体网络 All-to-all Reduction.

```
def A2AReduction (myid, msg, d, result):
    recloc = 0
    for i = d-1 to 0 do:
        partner = myid XOR 2^i
        j = myid AND 2^i
        k = (myid XOR 2^i) AND 2^i
        senloc = recloc + k
        recloc = recloc + j
        send msg [senloc .. senloc+2^i-1] to partner;
        receive tmp [0.. 2^i-1] from partner
        for j = 0 to 2^i -1 do
            msg [recloc+j] = msg [recloc+j] + tmp[j]
    result = msg [myid]
```

c) Scatter on a ring network.

def. Scatter (src, S, n):

$\quad d = n/2$; $A = \{src\}$; src.localmsg $= S$; src.msglen $= S.len$

$\quad$ while $d \geq 1$:

$\quad\quad$ ~~$cnt=0$~~ $T = \{\}$

$\quad\quad$ for node in A:

$\quad\quad\quad$ ~~send S~~

$\quad\quad\quad$ send node.localmsg [node.msglen/2:] from node to (node+d)%n

$\quad\quad\quad$ receive ~~node local~~ [(node+d)%n].localmsg.

$\quad\quad\quad$ T.add ((node+d)%n)

$\quad\quad$ $d = d/2$

$\quad\quad$ $A = A \cup T$

2. On Hypercube:

$$T = \sum_{i=1}^{\log p} (t_s + 2^{i-1} t_w m)$$

$$= t_s \log p + t_w m (p-1)$$

On 2-D Mesh:

$$T = 2 t_s (\sqrt{p} - 1) + t_w m (p-1)$$

3. a) Implement #1:

$T(n,p) \geq 6(n) + g(n)/p + k(n,p) = O(n^2/\sqrt{p} \cdot \sqrt{p}n)$ $\quad O(n^2/p + pn)$

$T_0(n,p) = Cost(n,p) - Cost(n,1) = p T(n,p) - T(n,1) \geq (p-1) 6(n) + p k(n,p)$.

~~$E(n,p) = Cost(n,1)/Cost(n,p) \geq 1/(1 + T_0(n,p)/T(n,1))$~~ ~~$= O(n^2/p \cdot \sqrt{p}n)$~~

$T(n,1) \geq C T_0(n,p)$ $\qquad\qquad\qquad\qquad = O(n^2 + p^2 n - n^2)$

$\Rightarrow n^2 \geq C p^2 n$ $\qquad\qquad\qquad\qquad\qquad = O(p^2 n)$

$\Rightarrow n \geq C p^2$ $\qquad\qquad M(n) = n \log n$

$\qquad$ Implement #2: $\qquad$ b) #1: $M(p(p))/p = c p^2 \log c p^2 / p$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad = c p \log c p^2$

$T(n,1) \geq C T_0(n,p)$ $\qquad$ #2: $M((p(1))/p = c p \log c p / p$

$\Rightarrow n^2 \geq C[n^2 + pn + pn^2 - n^2] \geq c p n$ $\qquad = c \log c p$

$\Rightarrow n \geq \alpha c p n$