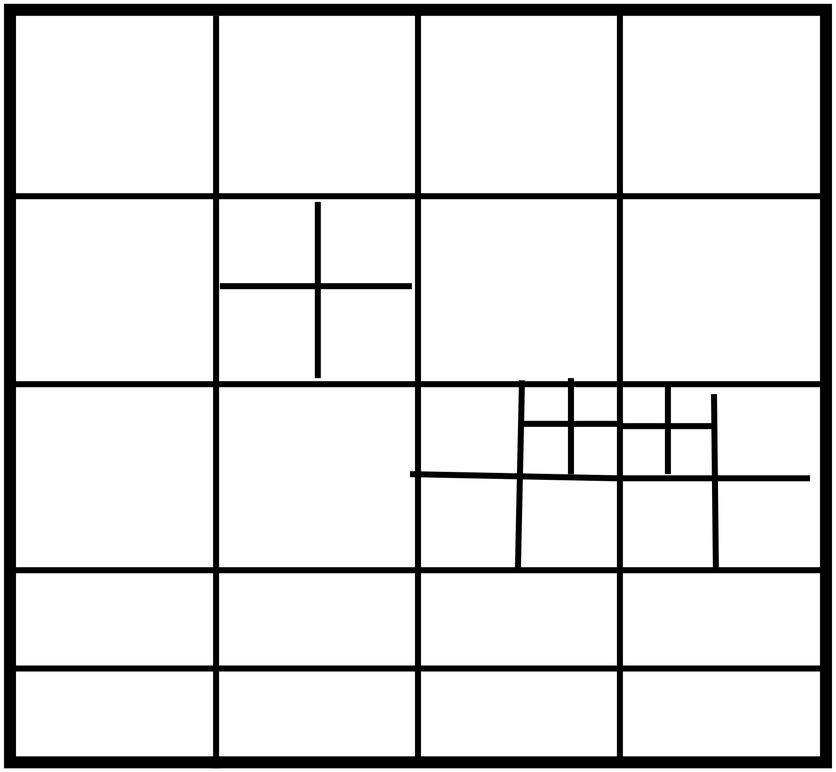
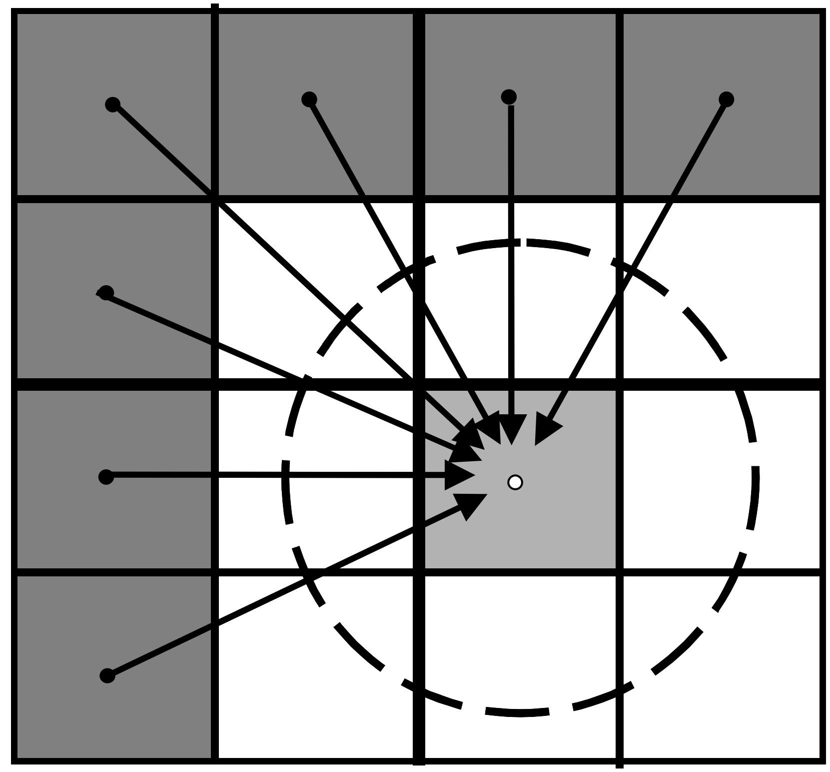
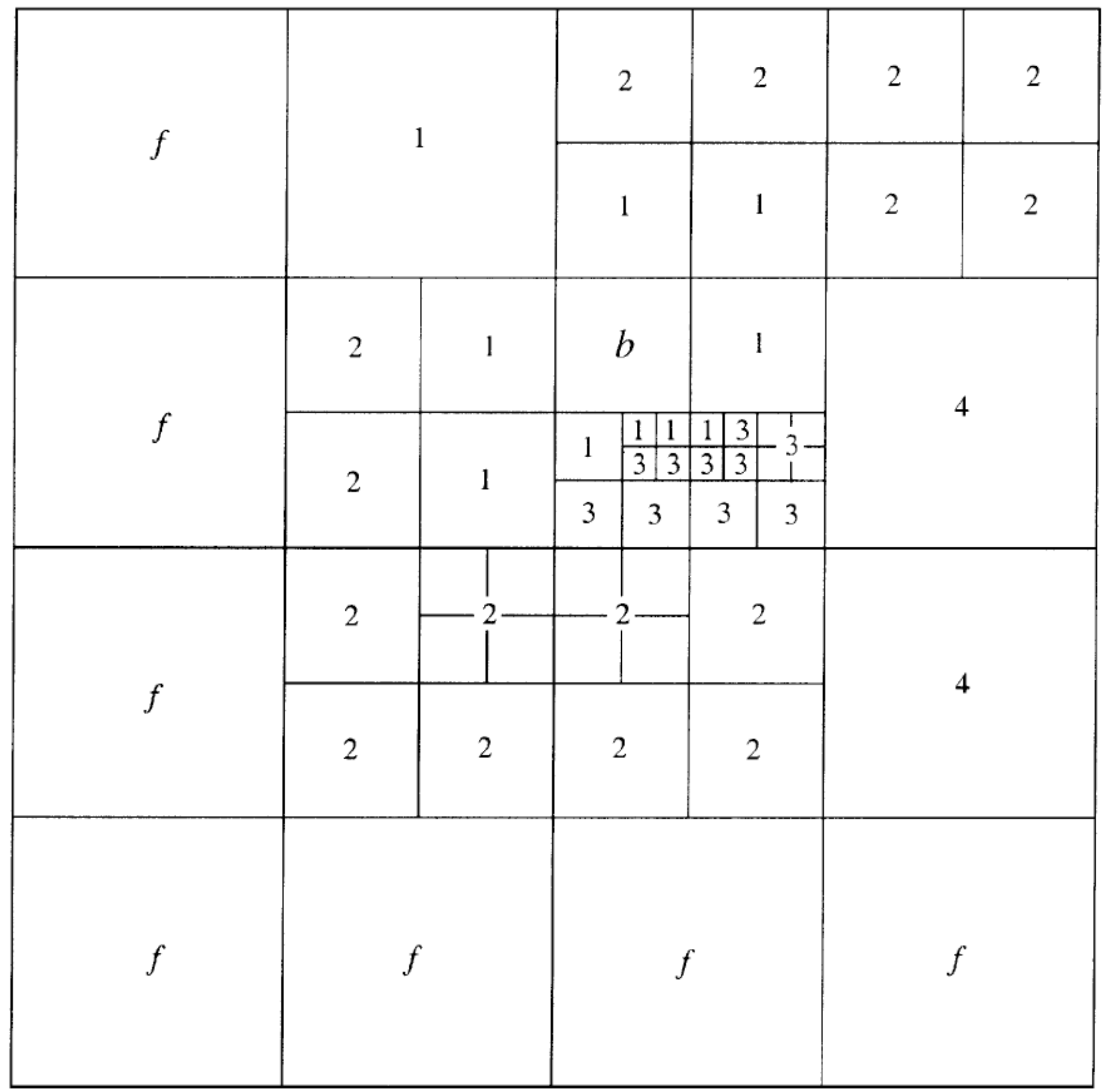
# Adaptivity

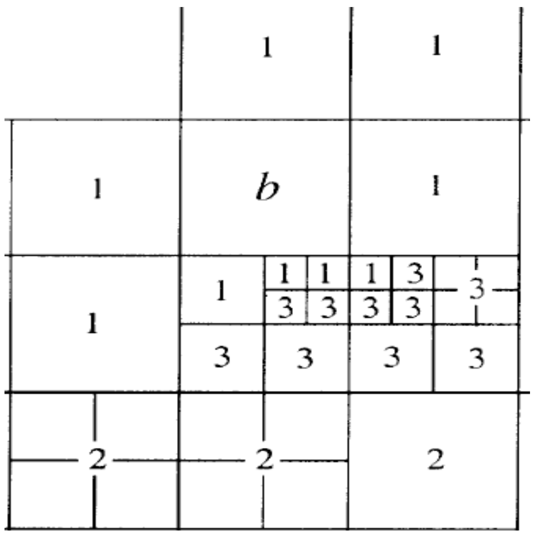


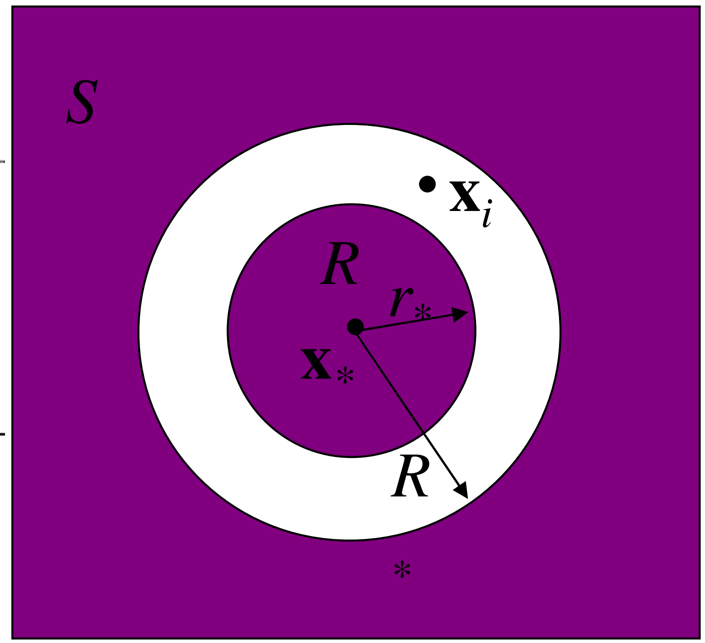


- Parameter *s* is determined by the box with most particles.
  - Most boxes will be empty (ok)
  - or have much fewer than *s* particles
- Reducing number of levels is good
- Alternate strategy
  - Continue subdivision so that each parent box has > ℓ points and each leaf-box has ≤ ℓ points
- Consider an algorithm due to Cheng et al (J. Comput. Phys. 1999).

- At the finest level consider evaluation at box *b.*
- It is surrounded by boxes
  - Coarser, Same or Finer level
  - Already considered, in a coarser S|R translation
- Divide surrounding boxes not already considered in to $L_1$, $L_2$, $L_3$, $L_4$ domains
  - Boxes $L_1$ share a boundary with box *b,* or they lie within the sphere of box *b* and need to be evaluated directly.
  - Boxes $L_2$ are separated by at least one box of size of *b* S|R translate these
  - Boxes in $L_3$ contain sources that lie outside the sphere of b and are closer than boxes $L_2$ R-preFMM these
  - Box *b* lies outside the sphere of boxes in $L_4$. but is too close to S|R. S-preFMM these






For $x_i$ in $L_3$ we can build R expansions in *b*

$r^* < R^*$

S-expansion: $|\mathbf{y} - \mathbf{x}_*| > R_* > |\mathbf{x}_i - \mathbf{x}_*|$

R-expansion: $|\mathbf{y} - \mathbf{x}_*| < r_* < |\mathbf{x}_i - \mathbf{x}_*|$

# Algorithm parameters & optimization

- Suggest that *P* and *l* should be balanced but do not provide an optimal choice
- A good project
  - to implement this and find out optimal choices.
  - compare this scheme with our scheme and check efficiency
  - Perhaps develop a combined scheme.