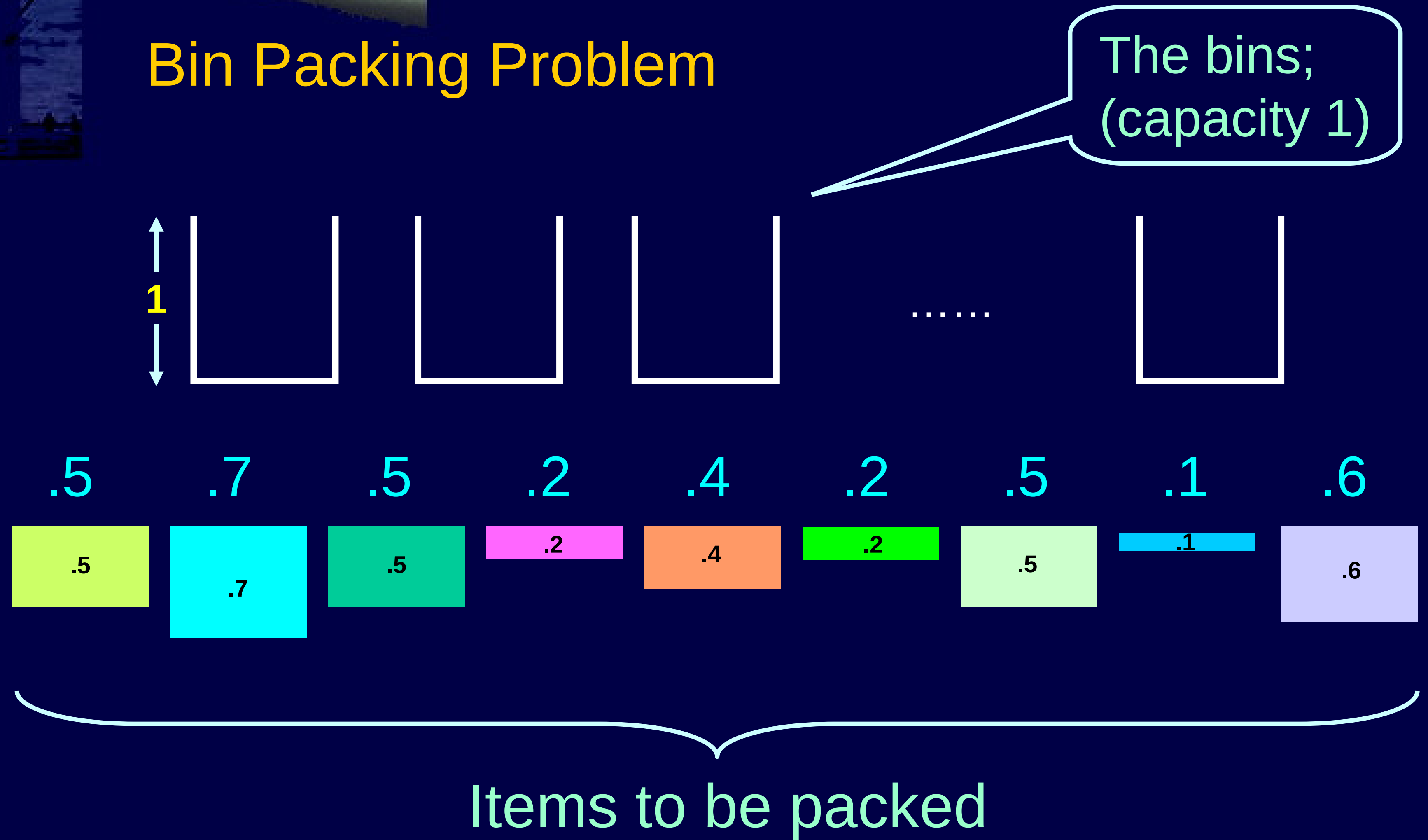
Bin Packing (1-D)

These slides on 1-D bin packing
are adapted from slides from
Professor C. L. Liu
(then of Tsing Hua University, Taiwan).

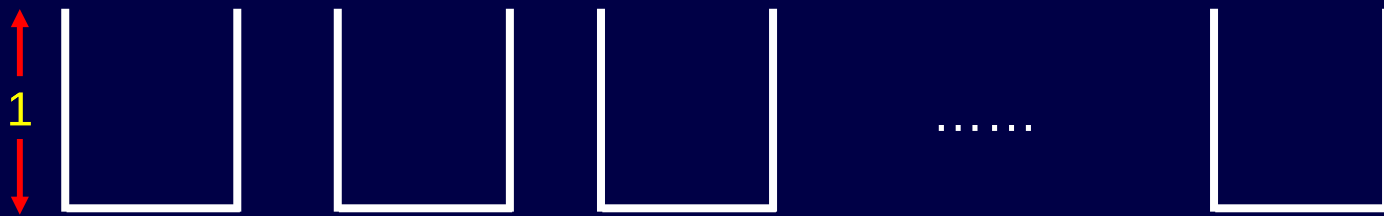
Bin Packing (1-D)

Bin Packing Problem



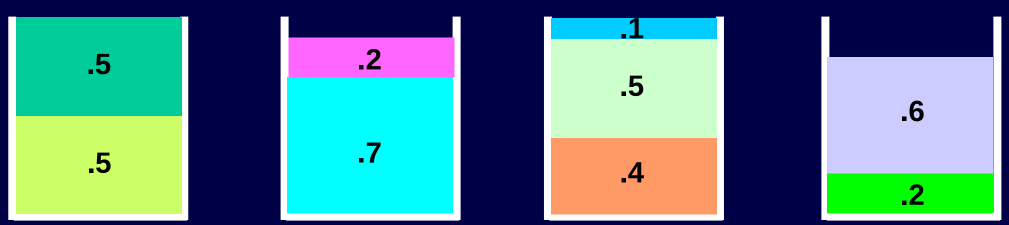
Bin Packing (1-D)

Bin Packing Problem



.5 .7 .5 .2 .4 .2 .5 .1 .6

Optimal Packing

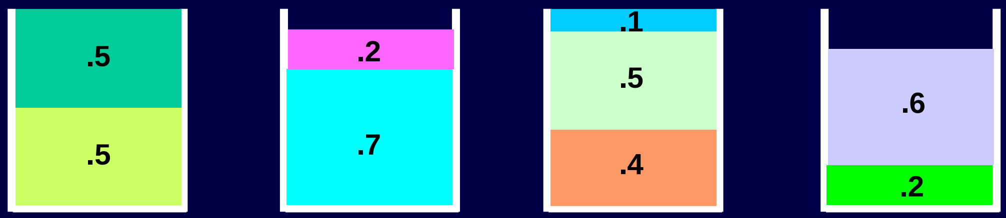


$N_0 = 4$

Next Fit Packing Algorithm

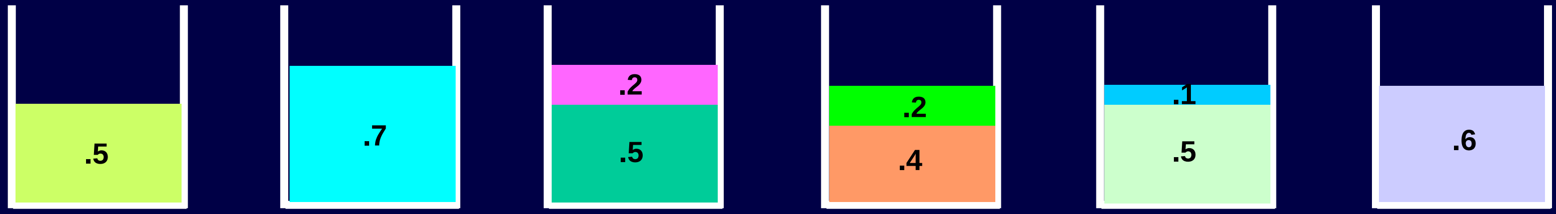
Bin Packing Problem

.5 .7 .5 .2 .4 .2 .5 .1 .6



$N_0 = 4$

Next Fit Packing Algorithm



$N = 6$

$$\frac{N}{N_0} \leq 2$$

Bin Packing (1-D)

Approximation Algorithms:

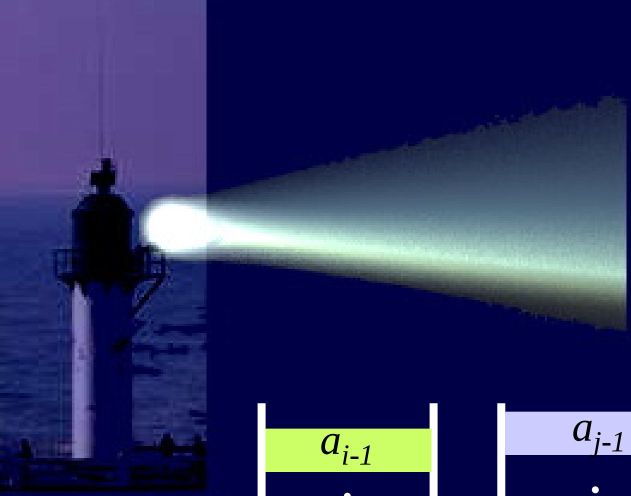
Not optimal solution,

but with some performance guarantee

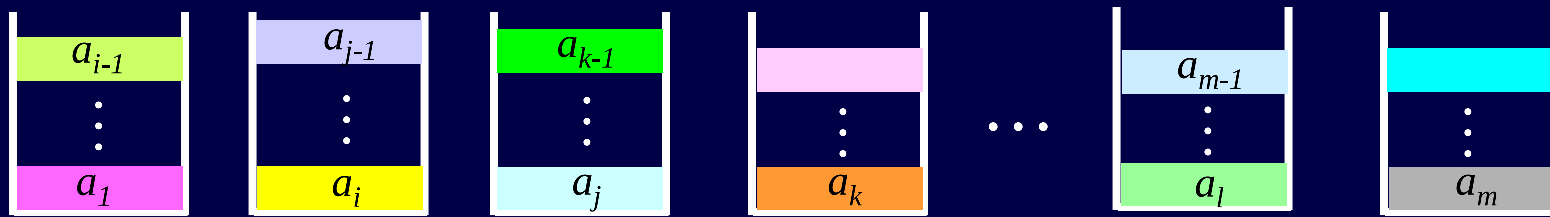
(eg, no worst than *twice the optimal*)

Even though

***we don't know what the optimal solution is*!!!**



Next Fit Packing Algorithm



$$a_1 + \ldots\ldots + a_i > 1$$

$$a_i + \ldots\ldots + a_j > 1$$

$$a_j + \ldots\ldots + a_k > 1$$

$$\vdots$$

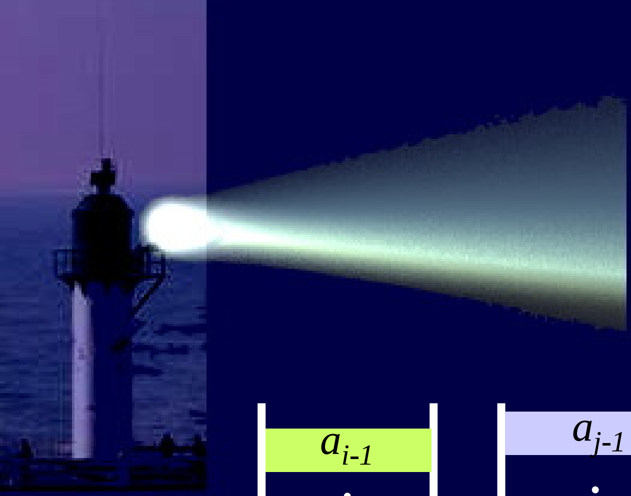
$$a_l + \ldots\ldots + a_m > 1$$

Let $a_1 + a_2 + \ldots\ldots = \Sigma$

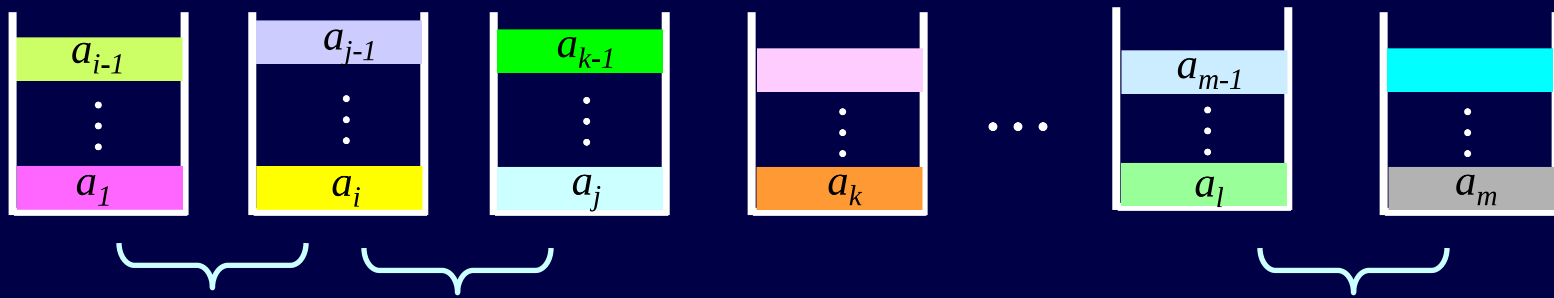
$$2\,\Sigma \geq N - 1$$

$$N_0 \geq \Sigma \geq \frac{N-1}{2} \geq \frac{N}{2}$$

$$\frac{N}{N_0} \leq 2$$



Next Fit Packing Algorithm (simpler proof)



$$s(B_1)+s(B_2) > 1$$

$$s(B_2)+s(B_3) > 1$$

$$\ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots$$

$$s(B_{N-1})+s(B_N) > 1$$

$$2(s(B_1)+s(B_2)+\ldots+s(B_N)) > N-1$$

Let $a_1 + a_2 + \ldots = \Sigma$

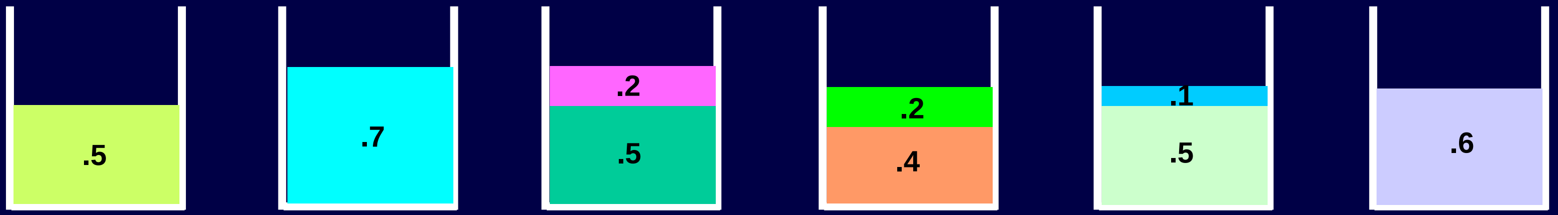
$$2\Sigma > N-1$$

$$2N_0 \geq 2\Sigma \geq N-1$$

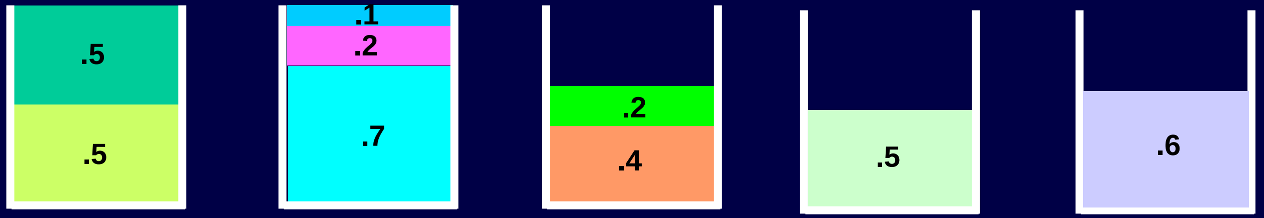
First Fit Packing Algorithm

.5 .7 .5 .2 .4 .2 .5 .1 .6

Next Fit Packing Algorithm



First Fit Packing Algorithm



$N = 5$

$$\frac{N}{N_0} \leq 1.7$$ *(Proof omitted)*