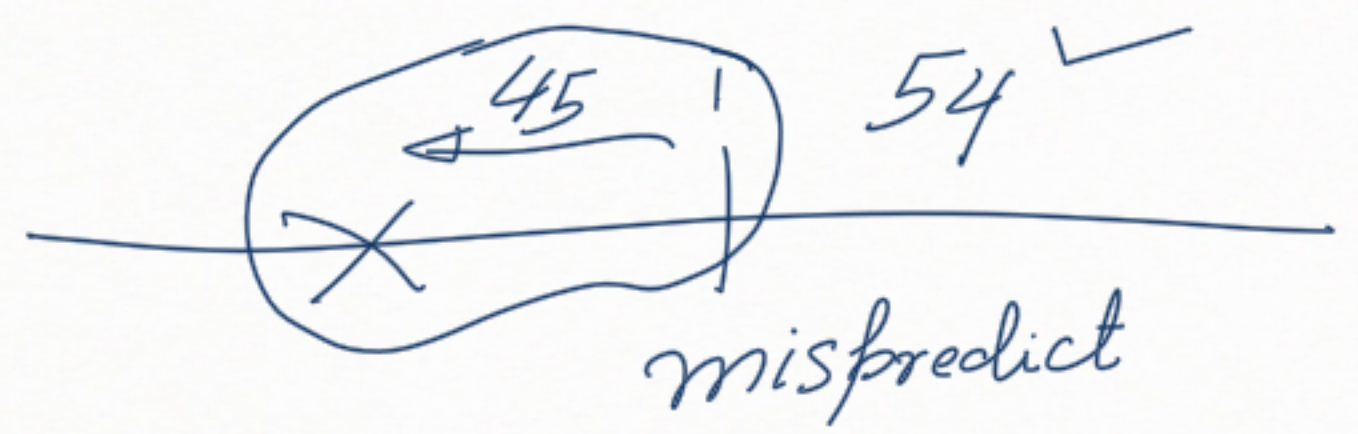
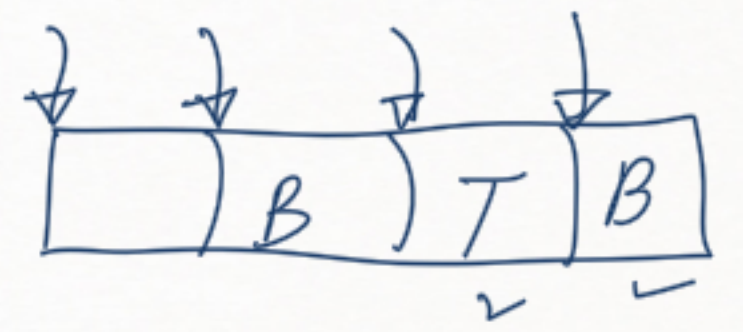
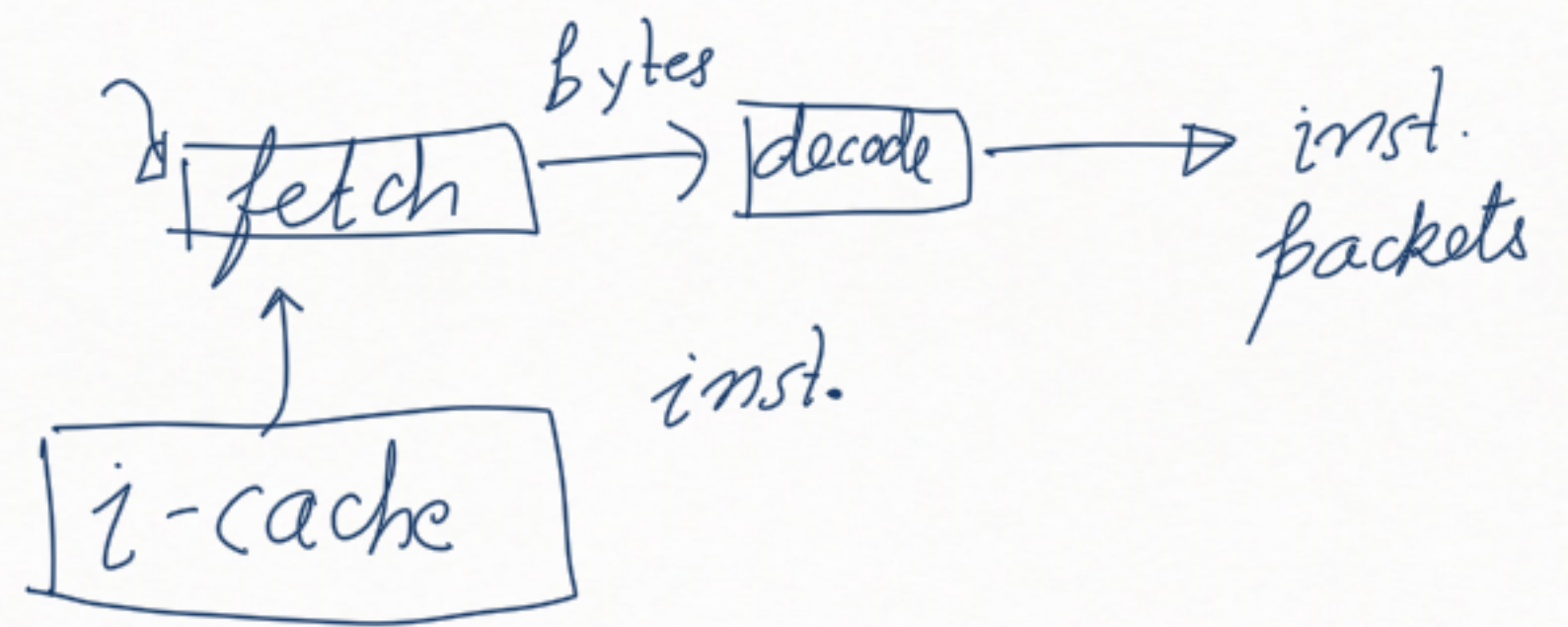


Extra work and discard.

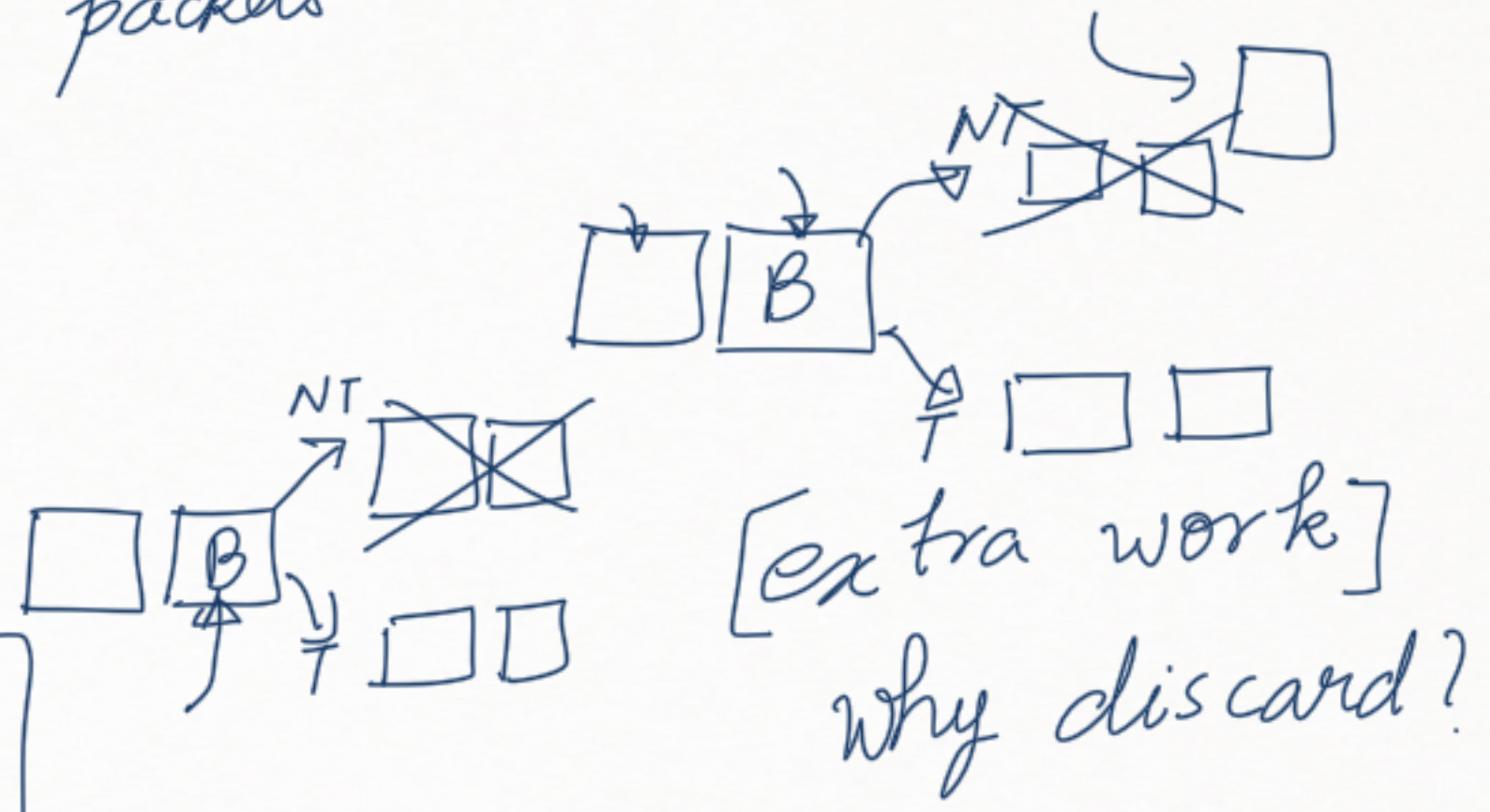
→ Parallelize

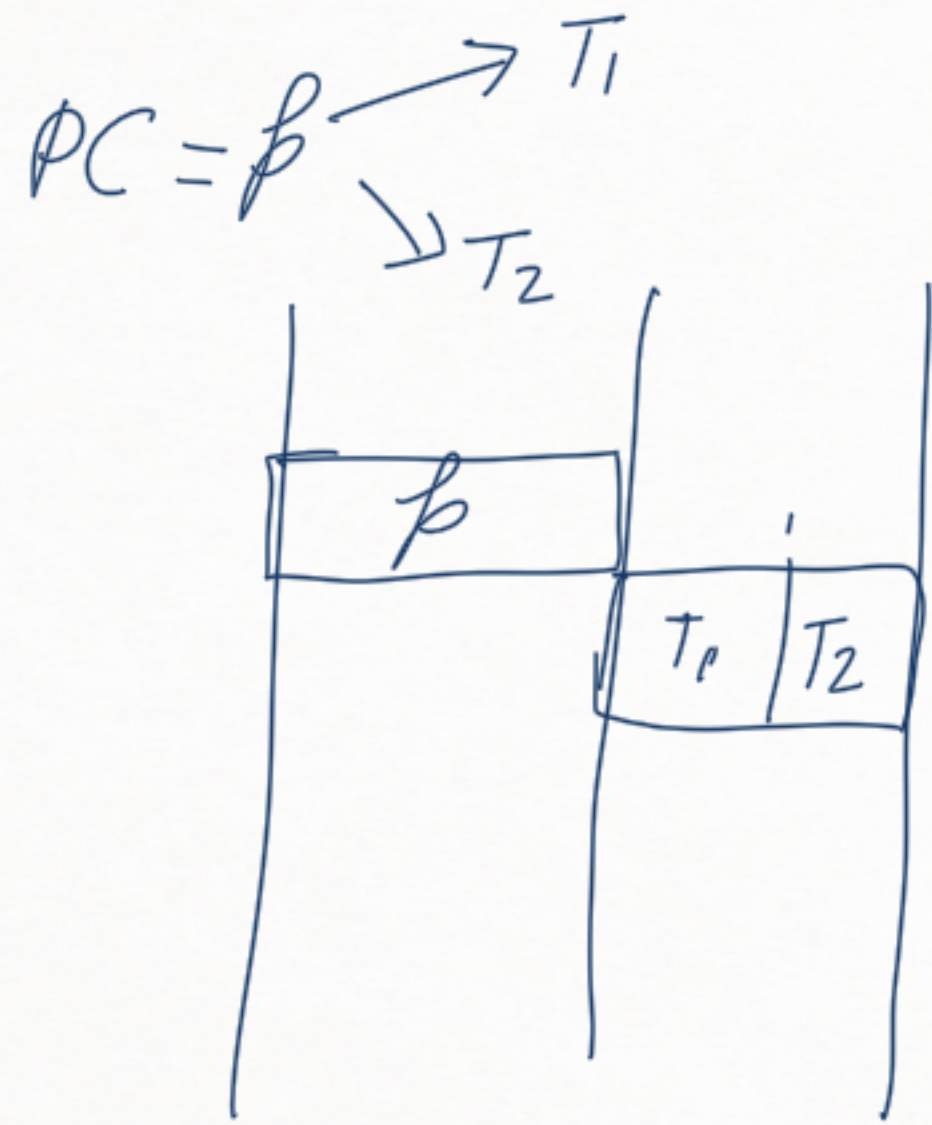


NO

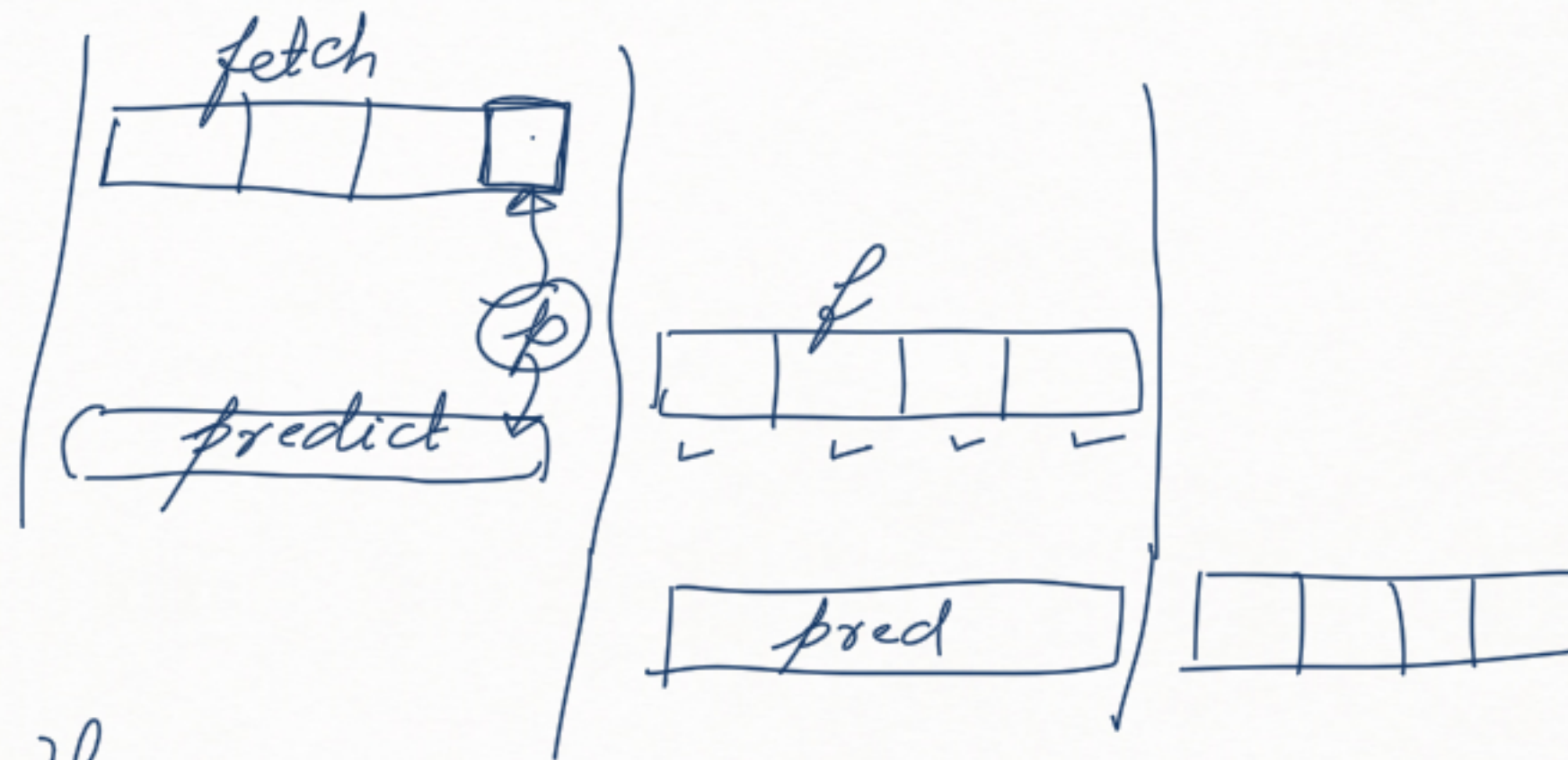


- High fetch BW
1. Do not contiguously place branches
 2. Parallelize: extra work and discard.





When I am fetching, all we have is the PC.
 We have not taken a look at the contents.



> Compilers always reorder the code.

$[-g]$ $[-01]$... $[-03]$
 precise exceptions \rightarrow SW
 \rightarrow HW

[BTB]
 \rightarrow type
 \rightarrow target

[Branch predictor]
 taken or
 not taken

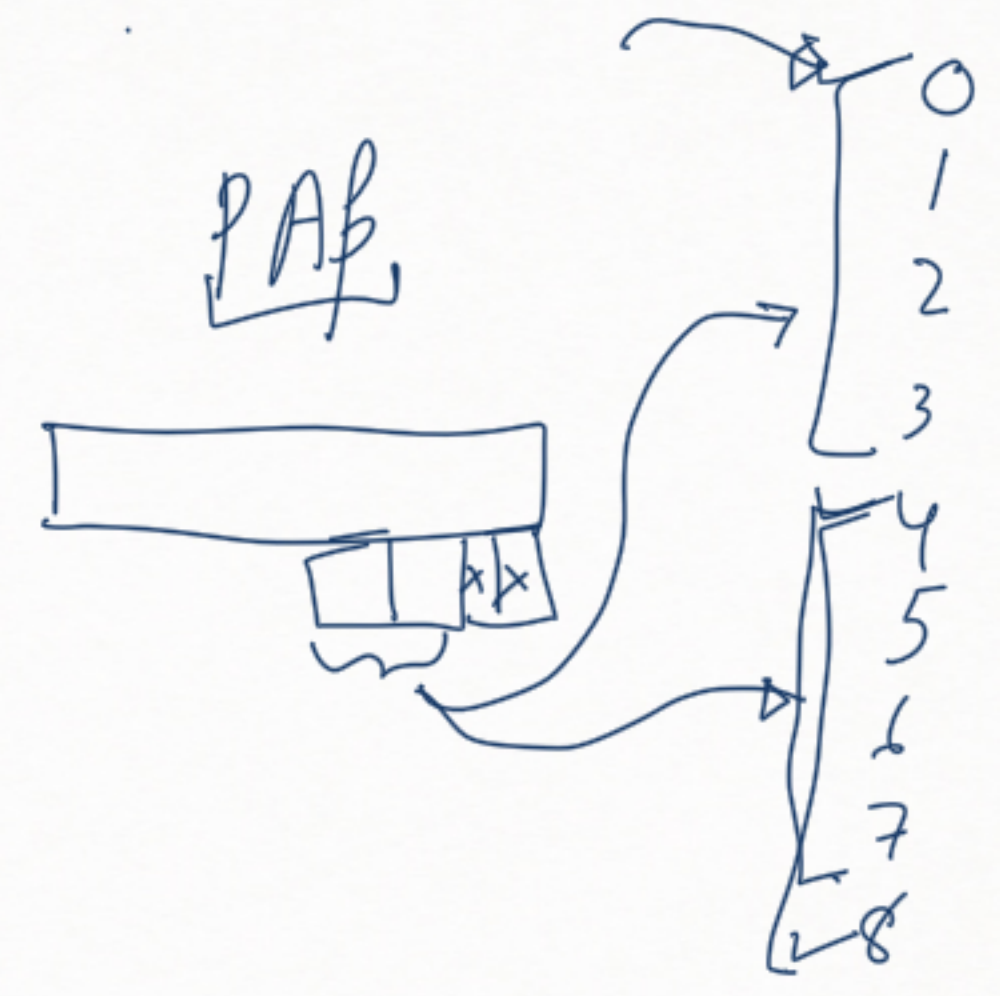
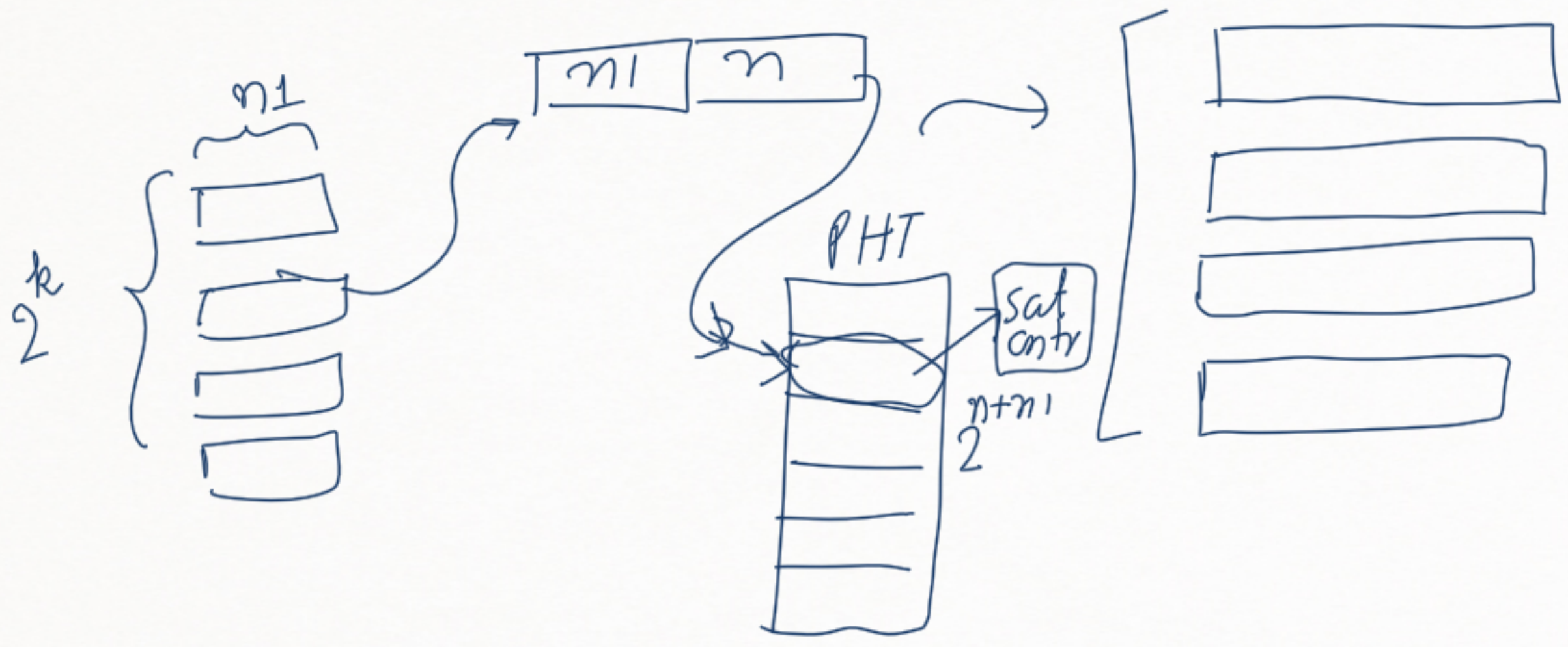
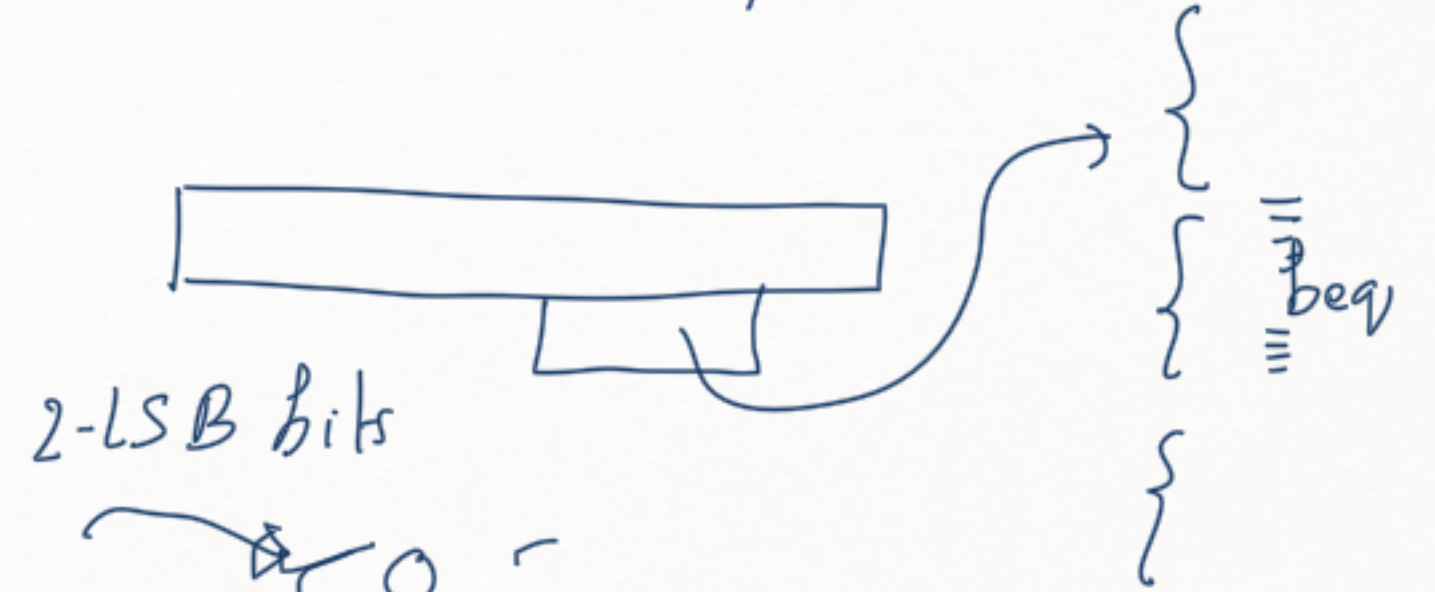
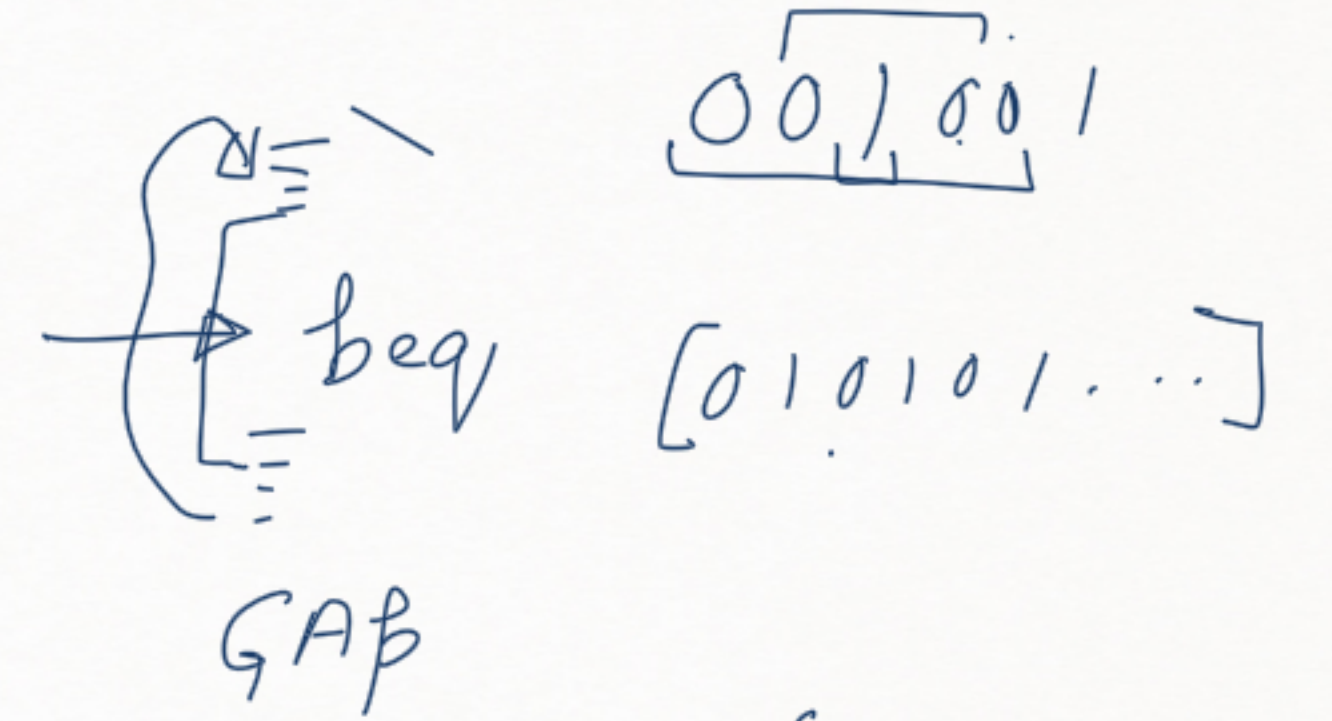
2nd Lecture

Generic of all programs

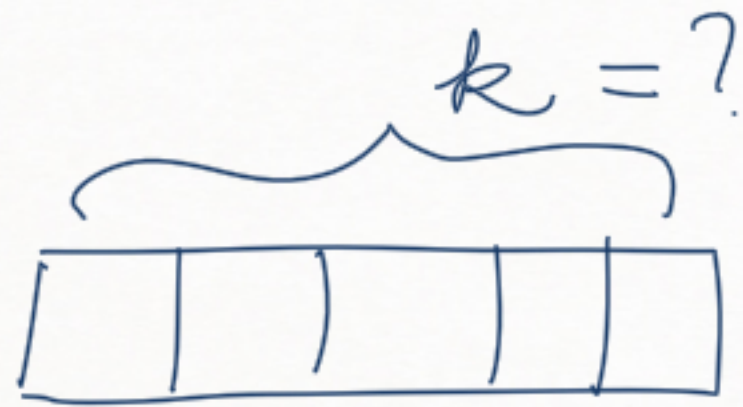
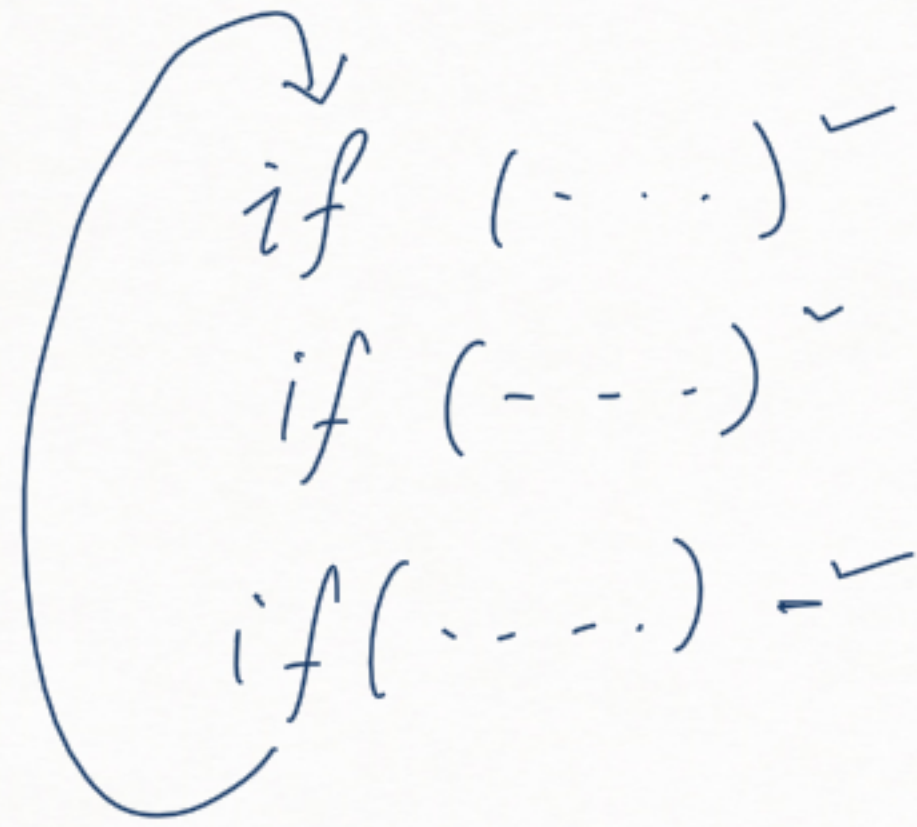
```

for (i=0; i<5; i++) {
    if (i==4) {
        //
    }
}
    
```

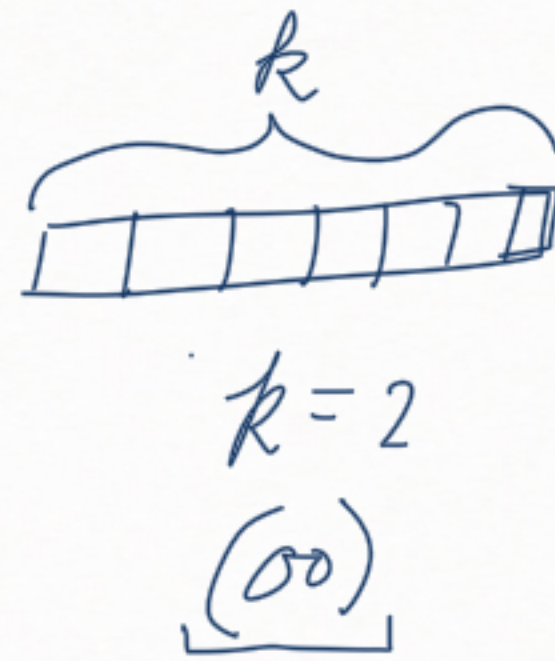
* GAB vs PAB
 → global history pollution



GHR per PC
 0 → 1
 1 → 0
 [GHR → range of PCs]

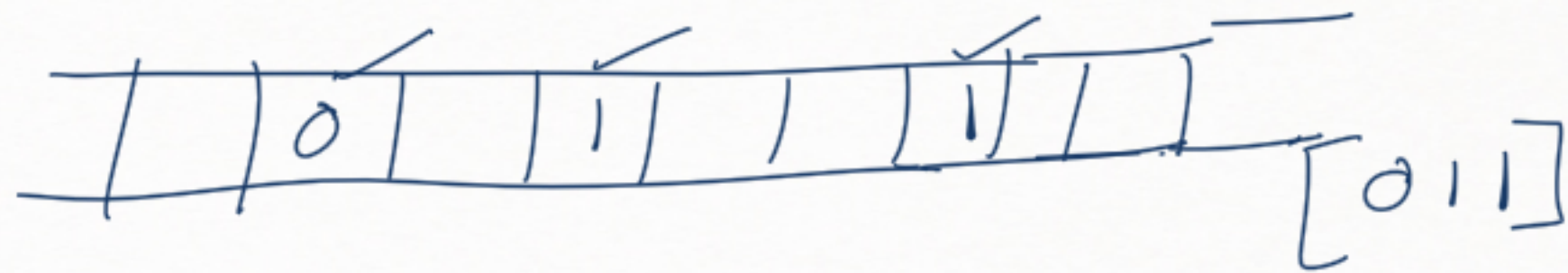
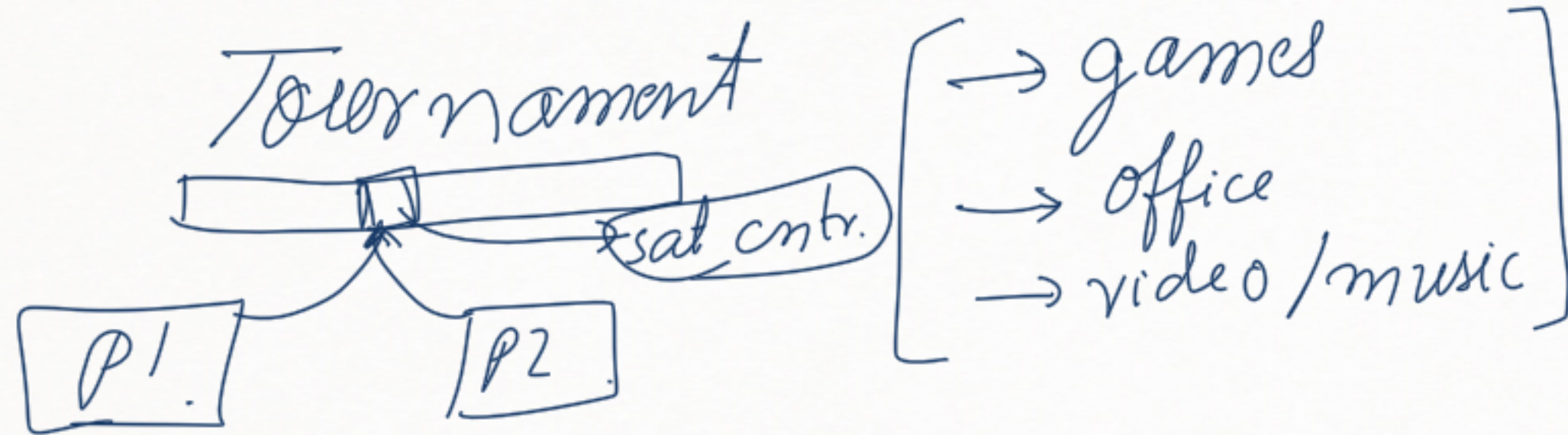


→ 200 benchmarks



saturating counter
single PC
(ignoring aliasing)

GHR → Behavior of the last (k) branches



lyshare

XOR → PC bits
+ GHR contents

0 1 0 1 0 1 0 1

0 1 0 0 0 1 0 1

Sat. counter helps

Boolean sense \rightarrow $\begin{bmatrix} \log_2 x \\ 2^x \end{bmatrix}$ \leftarrow

RAS stack \rightarrow

LIFO

\rightarrow TAGE

\rightarrow hierarchical perceptron predictor

Overfitting \rightarrow avoided