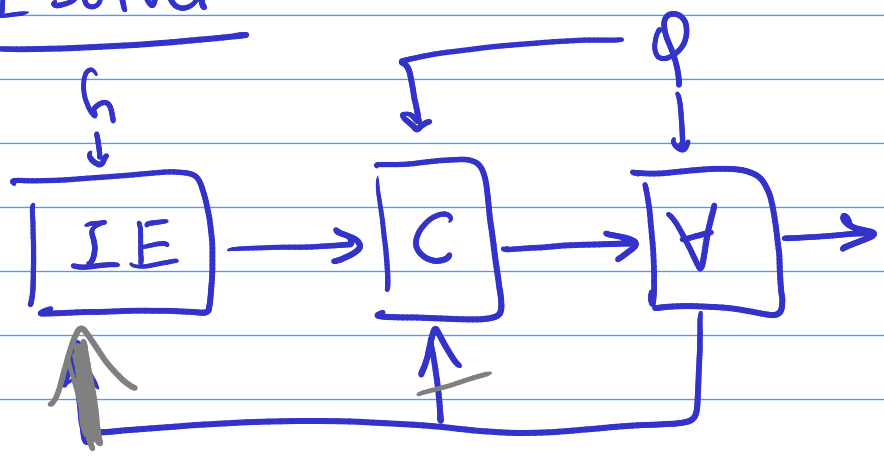


ESolver



Probabilistic Enumeration

Start ::= x | y | S+S | 1 | if SB then S else S
0.2 0.2 0.1 0.1 0.4

SB ::= S ≤ S | SB and SB $P(X+y) = 0.1 \times 0.2 \times 0.2$
0.5 0.5 $= \frac{4}{1000}$

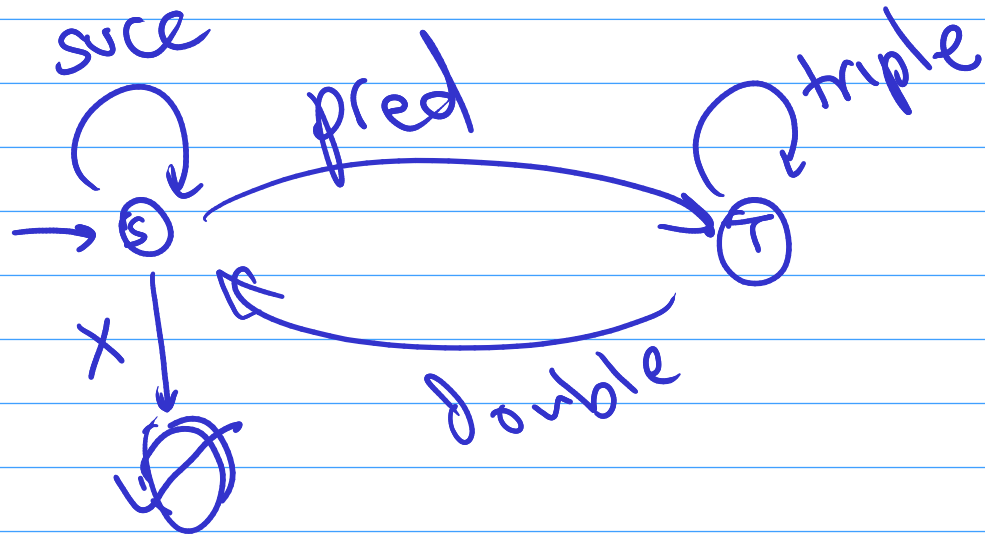
Ex: Regular grammar

$s ::= x \mid \text{succ}(s) \mid \text{pred}(\tau)$

$\tau ::= \text{double}(s) \mid \text{triple}(\tau)$

$\text{pred}(\text{double}(x))$

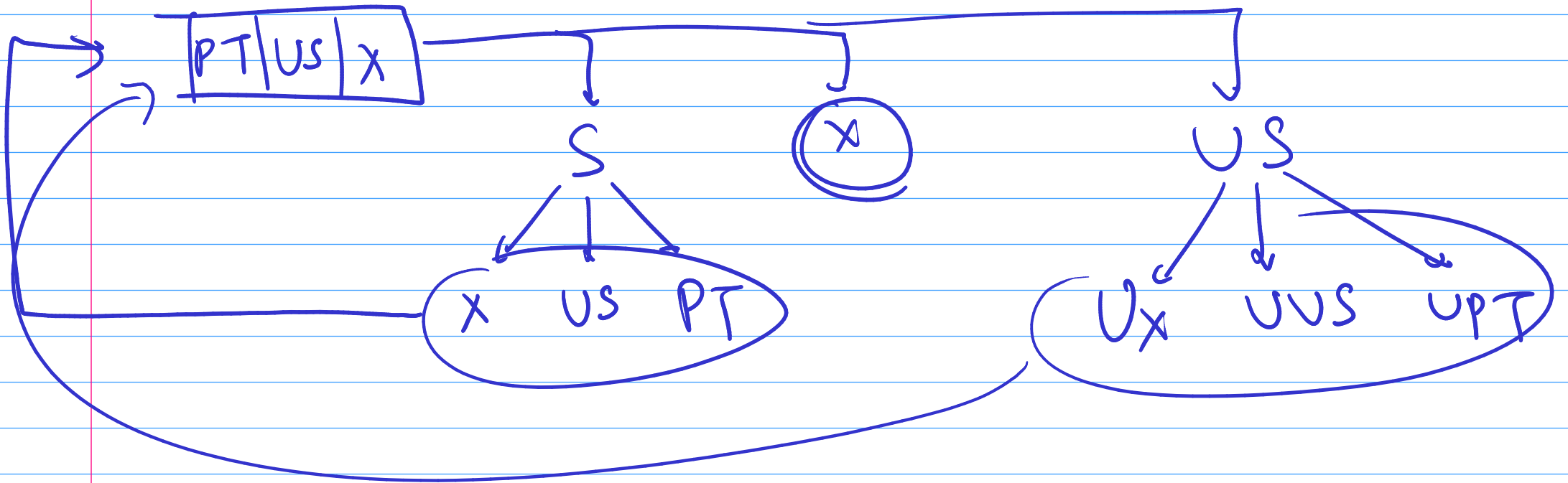
0.8 X
0.1 x 0.8 V X
0.1 PD X
x 0.7 x 0.8
PRDU X
;



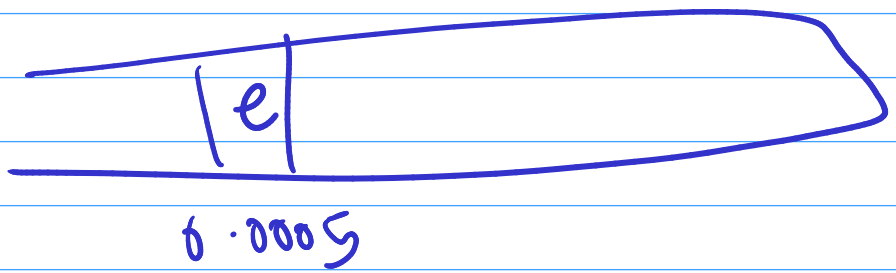
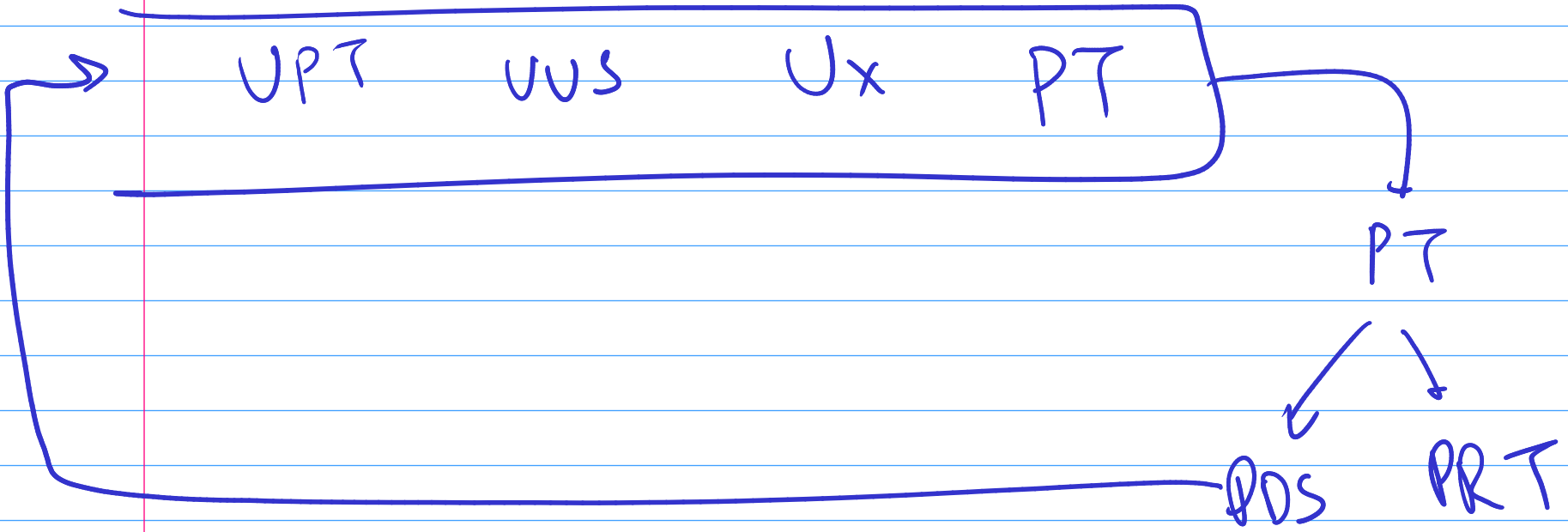
① This graph is a recognition algorithm ("automaton")

② I claim: it is also a generation alg.

$S \rightarrow \underline{US}, PT, \textcircled{X}$
 $\rightarrow \underline{UUS}, UPS, \textcircled{UX}, PT$
 \rightarrow



UPT | UUS | Ux | PT



Al for Prob-Enum

Q: priority queue of partial expressions (desc. prob)

Q := $\{s\}$

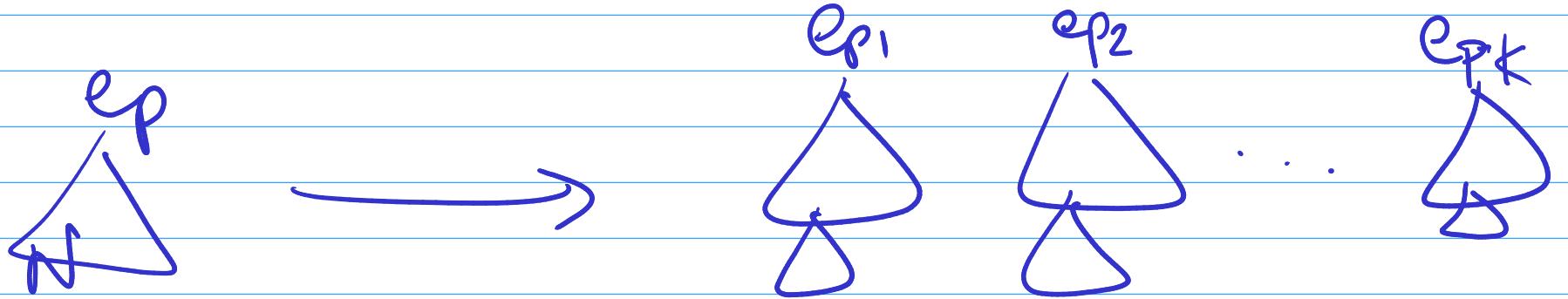
while Q not empty:

Let e_p be at the front of Q. Dequeue it.

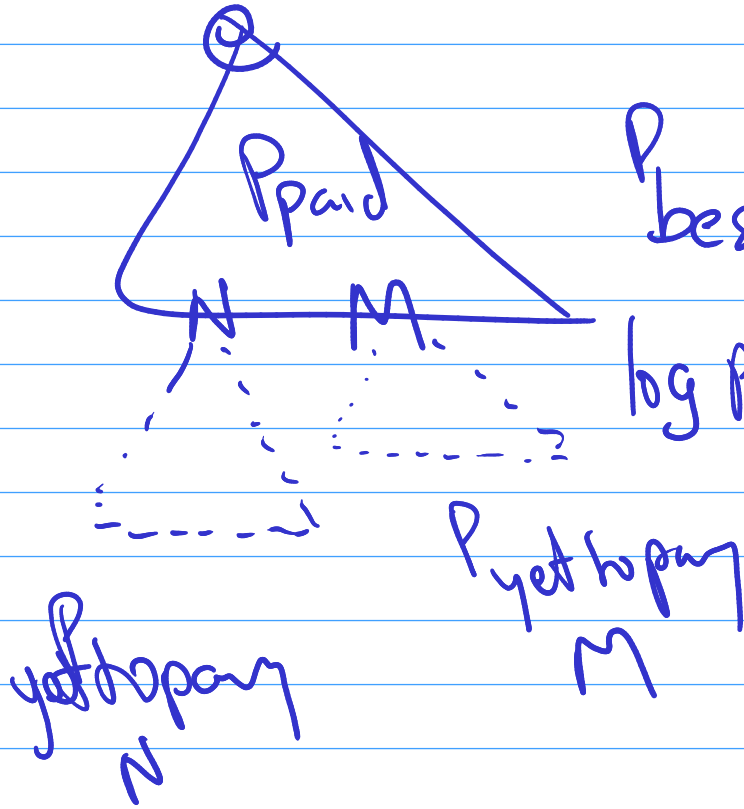
If e_p is ground: emit e_p

Otherwise: Pick nonterminal N in e_p .

Expand all its children



Insert e_{p_1} e_{p_2} ... e_{p_k} into Q .



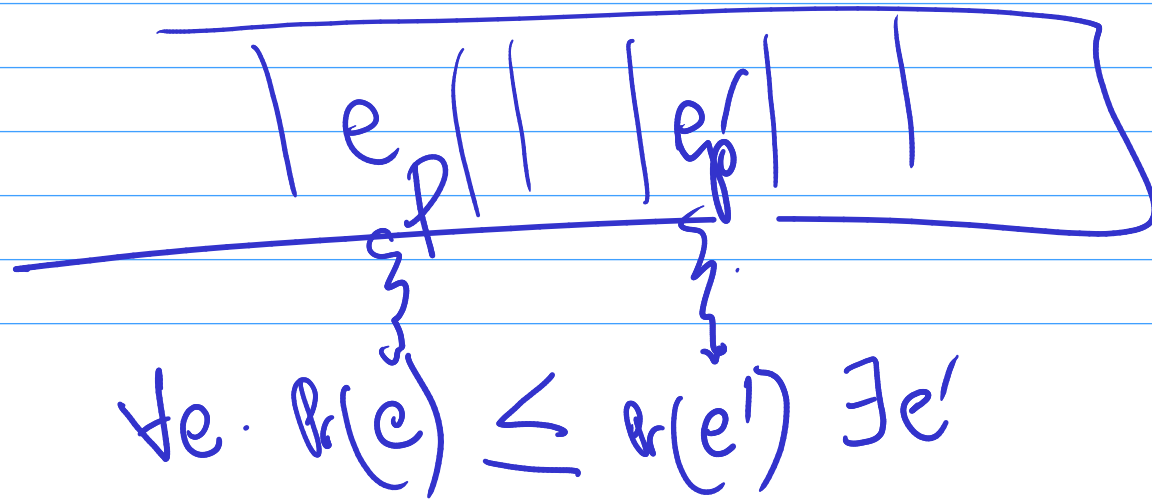
$$P_{best} = P_{paid} \cdot P_{ytpN} \cdot P_{ytpM}$$

$$\log P_{best} = (\log P_{paid}) + (\log P_{ytpN} \cdot P_{ytpM})$$

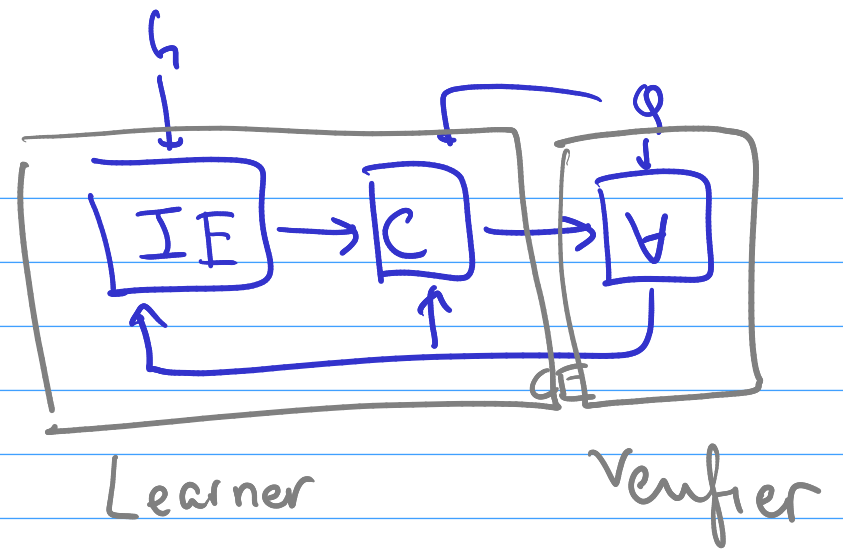
e'	e
$P_{paid} = 0.7$	$P_{paid} = 0.8$
$P_{best} = 0.3$	$P_{best} = 0.2$

Claim: Say we prioritize \mathcal{Q} by P_{best} (not P_{rand})

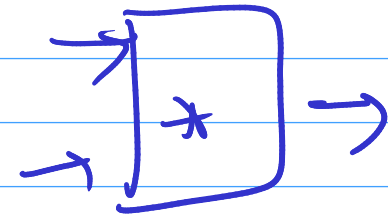
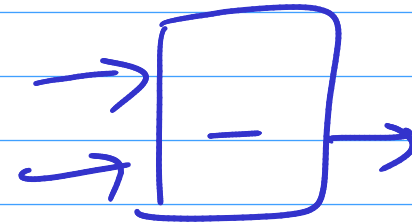
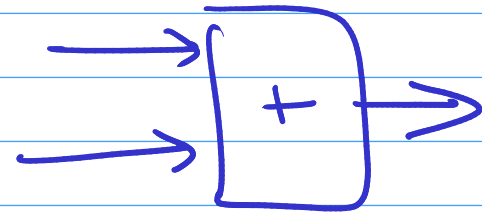
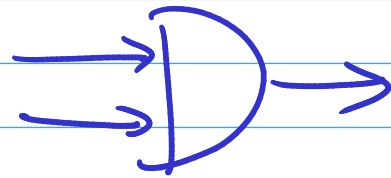
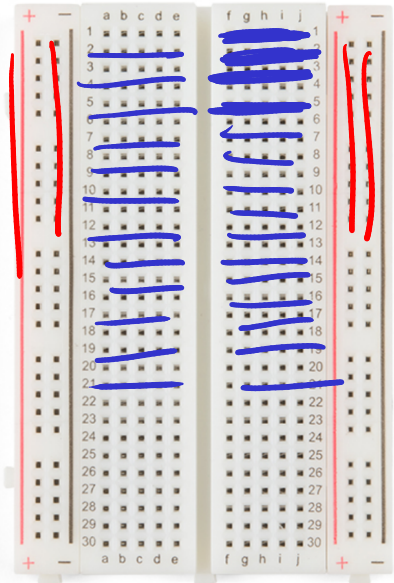
Run the enumeration alg for some number of steps & pause.



Symbolic Synthesizer



Counter-Example Guided
Inductive Synthesis



acyclic
 \exists wiring of the breadboard

\wedge inputs $\in \mathbb{C}$, $bb(\text{input}) = \text{exp. output}$

$$f(x, y) = x * (x + (y - 3))$$

(SSA) Static Single Assignment

$$o_1 = y - 3$$

$$o_2 = x + o_1$$

$$o_3 = x * o_2$$

$$y - 3$$

$$\underline{x + o_1}$$

$$\underline{x * o_2}$$

$$o_{-1} = x$$

$$o_0 = y$$

$$o_1 = y - 3$$

$$o_2 = x + o_1 \leftarrow$$

$$o_3 = x * o_2$$

$op_2 = +$ or $op_2 = -$ or $op_2 = *$

$$r_2 \leq 2 \quad l_2 \leq 2$$

$$op_2 \quad r_2 \quad l_2$$

- ① Which operator is here?
- ② What operands are used?