CS 10 9-29-08

INPUT: $m \geq 1$, $A = a_{m-1}a_{m-2}\cdots a_1 a_0$, $B = b_{m-1}\cdot b_{m-2}\cdots b_1 b_0$

OUTPUT: $C = c_m c_{m-1}\cdots c_1 c_0$

```
1.) carry ← 0
2.) i ← 0
3.) while i < m do 4-10
4.)     [ c_i ← a_i + b_i + carry
5.)     it c_i ≥ 10 do 6-7
6.)         [ c_i ← c_i - 10
7.)         [ carry ← 1
8.)     else do 9
9.)         [ carry ← 0
10.)    i ← i + 1
11.) c_m ← carry
12.) Print c_m ---- c_0
13.) stop
```

loop REPETITION CONDITION

loop BODY

Ex. $m = 3$, $A = 493$, $B = 751$

| $m$ | $a_2$ | $a_1$ | $a_0$ | carry | $i$ |
|---|---|---|---|---|---|
| 3 | 4 | 9 | 3 | ~~0~~ | ~~0~~ |
| | | | | 0 | X |
| | $b_2$ | $b_1$ | $b_0$ | X | ~~X~~ |
| | 7 | 5 | 1 | 1 | 3 |

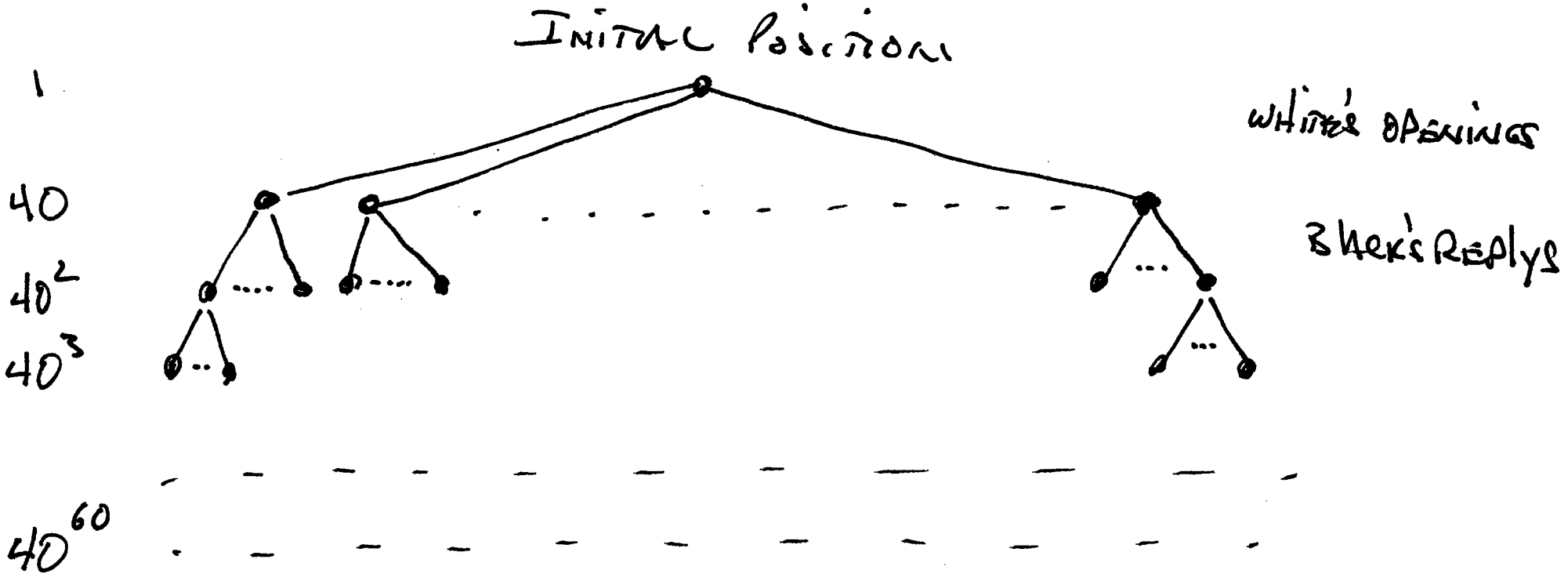
| $c_3$ | $c_2$ | $c_1$ | $c_0$ |
|---|---|---|---|
| 1 | ~~12~~ 2 | ~~14~~ 4 | 4 |
| ↓ | ↓ | ↓ | ↓ |
| 1 | 2 | 4 | 4 |

TYPES OF OPERATIONS:

- SEQUENTIAL
- ITERATIVE (i.e. LOOPS)
- CONDITIONAL (i.e. BRANCHING)

LIMITS OF ALGORITHMIC PROBLEM SOLVING.

EX. BRUTE FORCE CHESS ANALYSIS.




$40^{60} \times 10^{96}$

SUPPOSE CAN EVAL. $10^{18}$ (1 QUINTILLION) POS. PER SEC.

$$\text{time} = \frac{10^{96} \text{ POSITIONS}}{10^{18} \text{ POS/SEC}} = 10^{78} \text{ SEC} \times 10^{70} \text{ YRS.}$$

AGE OF UNIVERSE = $10^{10}$ YRS.

# FORMAL DEFINITION OF ALGORITHM

A WELL ORDERED COLLECTION OF UNAMBIGUOUS AND EFFECTIVELY COMPUTABLE OPERATIONS THAT, WHEN EXECUTED, PRODUCE A RESULT, AND HALTS IN FINITE TIME.

UNAMBIGUOUS ~ PRIMITIVE OPERATION

EX. 1.) DO something
2.) GO TO (1)

} NEVER HALTS

# Algorithm Design (chap 2)