

So, $\Delta x \geq \frac{h}{m \cdot v}$ → velocity of particle.
mass of particle
proton's size is smallest.

$$\Delta t = \frac{\text{Size of a proton}}{c \text{ (speed of light)}} \approx 10^{-23} \text{ secs.}$$

$$\Delta x \approx 10^{-13} \text{ cm}, \quad c \approx 3 \times 10^8 \text{ km/sec.}$$

Thus, computational steps that can be done during T → $\frac{6 \cdot 10^{17}}{10^{23}} \approx 6 \cdot 10^{40}$

10^{80} normal particles } If we consider all the particles are
 10^{90} particles overall } computing. Then 10^{130} steps

$$\text{So, } 26^n = 10^{130} \quad (10^{1.5})^n \approx 10^{130}$$

$$n = \frac{130}{1.5} \approx 87$$

[So, input size 87 for exhaustive search]

Tuesday.

3rd March: (spring 2008 qs.)

q.1. what is computable?

To prove something is not computable, we need to have formal description of computable function.

Church's thesis: everything that can be computed by a computational device can be computed by a Java program.

— So far it is true.

So to prove that something is not computable, we can prove that this cannot be computed by Java program.

prob: Java is huge, difficult to describe. It is impossible to prove anything with Java.

So, we needed a simplified definition that will still cover all Java-computable fs. but that will cover be easier & thus easier to prove.

1st attempt:— natural #s, 0, for-loops, ++, assignment } ⇒ PR fn.

But are we covering all computable fns? Almost all, but not all.

2nd attempt: μ -recursive function to have while-loops.

Anything we can do by Java prog, we can do by μ -recursive fⁿ.

So, if every computable function is μ -recursive if Church's theory is correct.

$\mu m (b+m=a)$ means smallest m for which $b+m=a$

$m=0;$
 $\therefore \text{while}(! (b+m=a))$

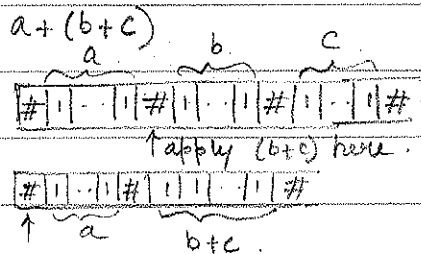
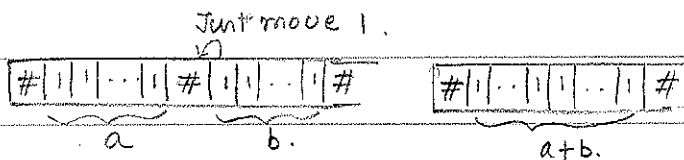
a) μ -recursive $\{m++; j\}$

positive(k) = $\begin{cases} 1 & \text{if } k > 0 \\ 0 & \text{otherwise} \end{cases}$

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int pos = 0;
for(i=0; i<n; i++)
{pos=1;}
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$(a-b) > 0 \rightarrow \text{positive}(a-b)$

\rightarrow This is PR function \rightarrow Thus μ -recursive.



Then apply $a+(b+c)$ here.

$(a \% b) = c$

$\mu c (a$

$5 \% 2 = 1$

$4 \% 2 = 0$

$a = a \% b + c$

$ab = a + c$

$ab - c = a$