1 Hello World! - Sump us disc OSB

Note 12 Determine the computability of the following tasks. If it's not computable, write a reduction or self-reference proof. If it is, write the program.

(a) You want to determine whether a program *P* on input *x* prints "Hello World!". Is there a computer program that can perform this task? Justify your answer.

print (Hello world)

print (Hello world)

habt problem

(b) You want to determine whether a program *P* prints "Hello World!" before running the *k*th line in the program. Is there a computer program that can perform this task? Justify your answer.

M

(c) You want to determine whether a program *P* prints "Hello World!" in the first *k* steps of its execution. Is there a computer program that can perform this task? Justify your answer.

Yes

Code Reachability

Note 12

Consider triplets (M, x, L) where

- M is a Java program
- x is some input
- L is an integer

and the question of: if we execute M(x), do we ever hit line L?

Prove this problem is undecidable.

Test holt (P, x)

ρ⁽ (λ):

return true specond like?

return reachable (P', x, 2):

return reachable (P', x, 2)

2

else:

return talse

Strings

Note 10

What is the number of strings consisting of:

(a) *n* ones, and *m* zeroes?

$$\left(\begin{array}{c} N \end{array}\right) = \frac{\left(N+\mu\right)!}{\left(N+\mu\right)!}$$

(b) n_1 A's, n_2 B's and n_3 C's?

$$\begin{pmatrix}
n_1 \text{ A's, } n_2 \text{ B's and } n_3 \text{ C's?} \\
\begin{pmatrix}
n_1 + n_2 + n_3
\end{pmatrix}, \qquad \begin{pmatrix}
n_3 + n_2
\end{pmatrix}, \qquad \begin{pmatrix}
n_3 + n_2
\end{pmatrix}, \qquad \begin{pmatrix}
n_1 + n_2 + n_3
\end{pmatrix}, \qquad \begin{pmatrix}
n_1 +$$

(c) n_1, n_2, \dots, n_k respectively of k different letters?

$$(n_1+n_2+\ldots n_p)$$

$$(n_1+n_2+\ldots n_p)$$

You'll Never Count Alone

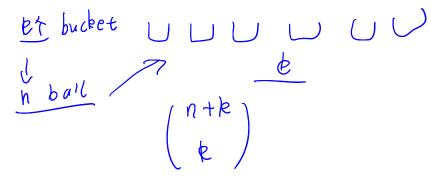
Note 10

(a) An anagram of LIVERPOOL is any re-ordering of the letters of LIVERPOOL, i.e., any string made up of the letters L, I, V, E, R, P, O, O, L in any order. For example, IVLERPOOL and POLIVOLRE are anagrams of LIVERPOOL but PIVEOLR and CHELSEA are not. The anagram does not have to be an English word.

How many different anagrams of LIVERPOOL are there?

$$\frac{q!}{(5+2+2)!} = \frac{q!}{4} = \frac{90720}{2! \cdot 2!}$$

(b) How many solutions does $y_0 + y_1 + \cdots + y_k = n$ have, if each y must be a non-negative integer?



(c) How many solutions does $y_0 + y_1 + \cdots + y_k = n$ have, if each y must be a positive integer?

$$\frac{k}{N-k} + \frac{ball}{k} = \binom{N-l}{k}$$