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Cpts 350

Homework 1

1. Let A be an algorithm to solve the following problem:

Given: number n ,

Question: Is there a number k such that $n = 3k$?

please describe input and output of A .

- The algorithm A takes a single integer or number n as input and returns a boolean value indicating whether there exists a number k such that $n = 3k$. If a k happens to exist in this context, A returns True and otherwise returns False. This type of algorithm is also known as a decision problem.

example would be:

```
def A(n):  
    if n % 3 == 0:  
        return True  
    else:  
        return False
```

2. Consider the following C-function:

Memory usage

The memory usage of an 'int' depends on the compiler but is 4 bytes. The amount of memory used by k is $4(i-1)$ bytes on a typical 32 bit system or $8(i-1)$ on 64 bit.

```
Bool Stupid(int i){
```

```
    int k = 1;
```

```
    while(1)
```

```
        if k++ == i break;
```

```
    return 1;
```

```
}
```

More reason, it increments k until it matches the input ' i ' and then breaks out of the loop to return 1. As an algorithm it lacks efficiency, practicality and clarity.

- complicated question, technically, stupid can be considered an algorithm but its not an efficient algorithm. An algorithm is a set of instructions designed to perform a specific task. This algorithm does not have a clear set of instructions so it can be said it cannot be considered an algorithm.

- * 3. Mr. X describes his algorithm called Foo using pseudo-code as follows:

Input: integer i

Let k be an integer variable initialized to be 1;

while(1)

if $k++ == i$ break;

ret yes;

is Foo an algorithm? Briefly state your reasoning.

How much memory does k use?

- Yes, Foo can be considered an algorithm. Foo takes an integer being i as an input and checks if k equals i . If k equals i , it will break the loop and returns 'yes'. Since this procedure exists, it means Foo is an algorithm.
- In terms of memory I believe this would be 4 bytes in size.

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4. Memory size is measured in bits. Assume that we have 64 students in our class. Consider the following:

pseudo-code segment:

for each student in our class

if student is sleepy, wake him/her up;

What is the minimal memory size that student takes?

- The minimal memory size that 'STUDENT' takes in this context is 6 bits. A size that is sufficient to handle 64 students in class.
- The smallest # of bits that can achieve it is 6 since, $2^6 = 64$. With 6 bits you can represent values 0 to 63 allowing to uniquely identify each student.

*

5. Let Q be an arbitrary C-program without input. Consider the following 'code' P :

input: Q and integer i

if Q runs forever

return $2i$

else return i ;

is P an algorithm?

- P cannot be considered an algorithm, algorithms must be finite, P takes a C-program Q and an integer i as input, it checks if Q runs forever, like an infinite loop or non-terminating and if it does, P returns $2i$; or returns i . It does not solve a problem nor describe how to solve a problem.