CS 3141: Prof. Kamil's Algorithm Analysis

July 13, 2020

Homework Class Test

This is a demonstration of my homework LaTeX class. It is an extension of the amsart and should have all of its functionality. These are some of the set symbols: $\mathbb{C} \supset \mathbb{R} \supset \mathbb{Q} \supset \mathbb{Z} \supset \mathbb{N}$, then some Greek and other mathematical symbols are, $\alpha, \varepsilon, \partial, \rightarrow, \Rightarrow, \hookrightarrow, \rightarrow, \rightarrow$. We can also insert multiple figures as seen in figure 1. There is also an org-mode version of this file ¹.





the Inst quadrate, which is the square, and the two quadrangles on its side, which are then roots, make together thirty-nine. In order to complete the great quadrate, there wants only a square of five multiplied by five, or treasurely-fee. This we add to thirty-nine, in order to complete the great square S. H. The sum is instruction. We extract its root, eight, which is one of the sides of the great quadrangle. By subtracting from this: the same quantity which we have before added, namely five, we obtain these as the remainder. This is the side of the quadrangle A. B, which represents the optare; it is the root of this aquare, and the square tself in nine. This is the figure:—

G B

Demonstration of the Case: "a Square and twenty-one Dirhems are equal to ten Roots,"*

We represent the square by a quadrate A D, the leigth of whose side we do not know. To this we join a parallelogram, the breadth of which is equal to one of the aides of the quadrate A D, such as the side of M. This paralellogram is H B. The length of the two

Figure 1. Al'Khwarizmi

Question 1. Prove that $\exists (x,y) \in \mathbb{Z}$ such that x+y=4. We show,

Proof. Four is the sum of two integers.

$$1, 3 \in \mathbb{Z} \text{ and } 1 + 3 = 4.$$

QED.

Bonus Question 1. Bonus Question Statement

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

$$\zeta(x) = f(g(x))$$
 then according to the chain rule: $\frac{\mathrm{d}\,\zeta}{\mathrm{d}\,x} = \frac{\mathrm{d}\,f}{\mathrm{d}\,g} \times \frac{\mathrm{d}\,g}{\mathrm{d}\,x}$

Bonus Question 2. Euclidean Algorithm

You may write code,

```
1 def gcd(x, y): # x > y
2     x0, x1, y0, y1 = 1, 0, 0, 1
3     while (y > 0):
4          print('\\gcd(%d, %def) &: %d &&= ' % (x, y, x), end='')
5          q, r = divmod(x, y)
6          # print('%d \\times %d + %d &&\\quad' % (q, y, r), end='')
7          # print('[%d, %d] - %d[%d, %d] = ' % (x0, x1, q, y0, y1), end='')
8          x, y = y, r
9          x0, x1, y0, y1 = y0, y1, x0 - q * y0, x1 - q * y1
```

¹Tashfeen's org-mode configurations can be found here.

```
# print('[%d, %d] \\\\' % (y0, y1))
return x, x0, x1
```

Question 2. What is the cardinality of Natural Numbers? It is \aleph_0 [?].

Question 3. Is the cardinality of Naturals and Reals the same because they are both infinite? No, the cardinality of Reals is greater because they are also un-listable (uncountable).

Question 99. Custom Numbering.

This question is numbered 99.

Question 4. Finally the numbered bullets are done with the enumerate package,

- 1) With just bullets,
 - Cats
 - Dogs

BAYT EL-HIKMAH