METHOD - 2014 - Exercices

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1 Writing Proofs

1.1 Divisions

Suppose we want to prove the following theorem:

Theorem 1 *Let a, b, be integers. If $a|b$ and $2|a$, then $2|b$.*

A student wrote the following "proof":

Proof: Let a, b be integers.

$$\left.\begin{array}{l} a|b \Rightarrow b = ak \\ 2|a \Rightarrow a = 2j \end{array}\right\} \Rightarrow b = 2jk$$

So $2|b$. □

Question 1 What is wrong with the tentative proof?

Question 2 Rewrite the proof correctly.

1.2 Tiles

Consider the following three regions A, B, and C depicted in Figure 1.

We conjecture the following theorem is true:

Theorem 2 *Of the three regions show in Figure 1, region A can be tiled with 1×2 tiles, but regions B and C cannot.*

Question 1 Proove or disprove the conjecture.

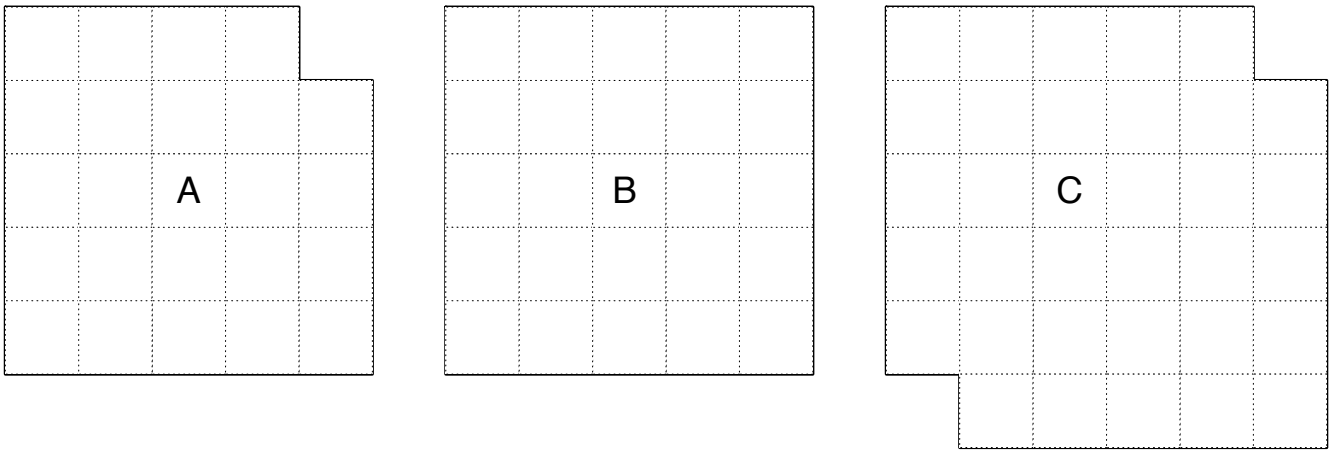

Figure 1: Regions to be tiled

2 Data Analysis

2.1 Dataset

In this exercice, we consider a dataset of intercontacts in a conference. People have an (anonymized) identifier (from 1 to 41) and the time is discretized. One line of the dataset is for example:

```
18 7 20733 21697
```

This means that the person with identifier 18 has met the person with identifier 7 starting with time 20733 and ending with time 21697. The dataset can be fetched at URL:

```
http://www-npa.lip6.fr/~tixeuil/m2r/uploads/Main/dataset.txt
```

2.2 Analysis

We want to answer a few basic questions about the dataset. In each case, describe the methodology used to obtain the result.

Question 1 How are intercontacts durations arranged along time?

Question 2 What is the average intercontact duration, what about the variance?

Question 3 What is the intercontact duration distribution?

Question 4 Does the global intercontact duration distribution differ from the individual distribution?

Question 5 Is there a time dependency for intercontact durations?

Question 6 What else can you deduce from the dataset?