## PROBLEM 1

? *There is some spatial data available you should process using ArcMap in order to emphasize particular areas of interest.*
*Your first task is to highlight all areas less than 1000 meters away from the next main road.*

Before actually solving the problem, I had to set up properly the ArcMap workspace that is used all the way through this and the two follow-up problems.

An empty workspace welcomes me with a warm smile ☺
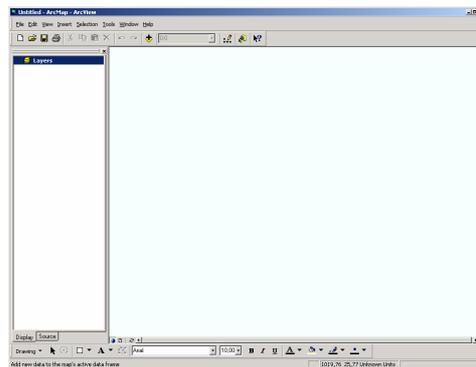
**Figure 1**　*An empty workspace*

After right-clicking *Layers* in the sidebar on the left side of the window, a menus pops up enabling me to add all five data sets by repeatedly invoking *Add Data*. Then, the map becomes gradually populated by our desired items. Here are two exemplary screenshots:
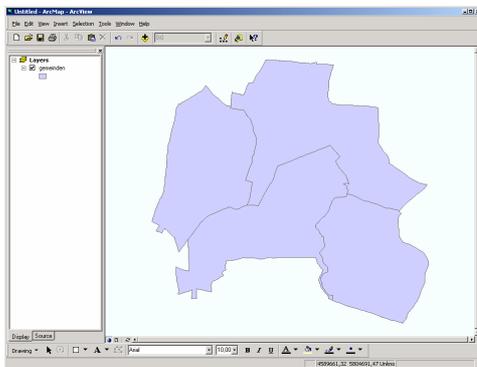
Figure 2　*Municipals*
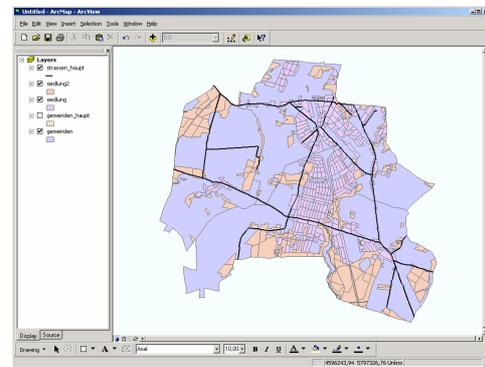
**Figure 3**　*Homesteads and streets*

Figure 3 has been slightly modified with the intention of accentuating the streets. I altered their type to *major roads* so they became a bit thicker. All five layers bear German names because the data set has been taken from a German region (I am not sure – it could be a small part of Berlin). ArcMap offers at least two ways to rename a layer: the simplest but not very intuitive one is to select a layer and then clicking it again. Another interesting feature of this program allows one to reorder the layer in the sidebar, especially when the layers are not drawn in the desired order – ArcMap always draws the top-most layer last which may occlude parts of the previous. The result of all the steps mentioned can be seen in Figure 4 on the next page.
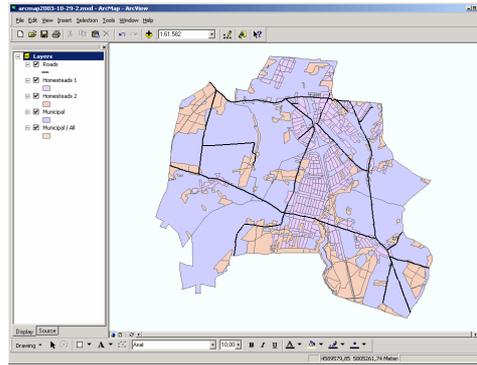
Figure 4   *Initial composition of all five layers*

The problem statement asks to highlight the region within 1000 meters. Before I can accomplish that aim, I need to define explicitly the metric scale. The *Properties* of *Layers* contain a tab named *General* where I found a drop-down list *Units*:
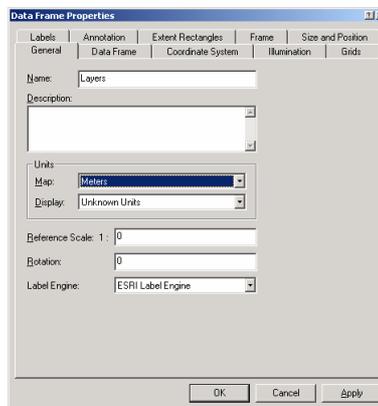
Figure 5   *Switching to meters*

ArcMap is capable of computing and composing buffers. Such a buffer has been created based on the *Roads* layer. Figure 6 to Figure 8 demonstrate the single steps. These dialogs were found in the menu *Tools → Buffer Wizard*.
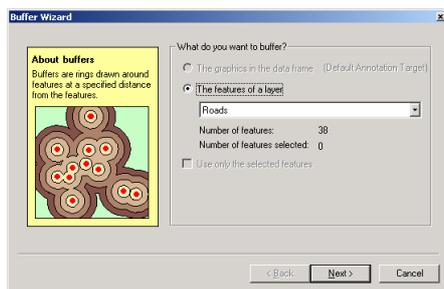
Figure 6   *Tell ArcMap about the layer used*
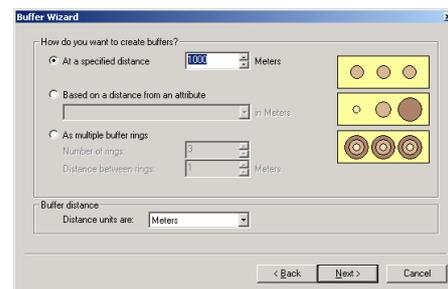
Figure 7   *Distance of 1000 meters*
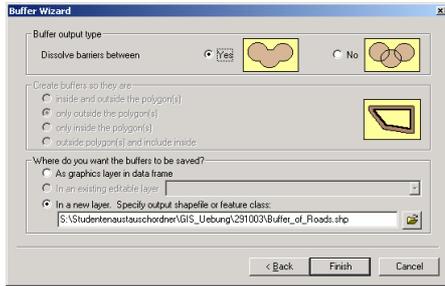
Figure 8 *Output a new layer*
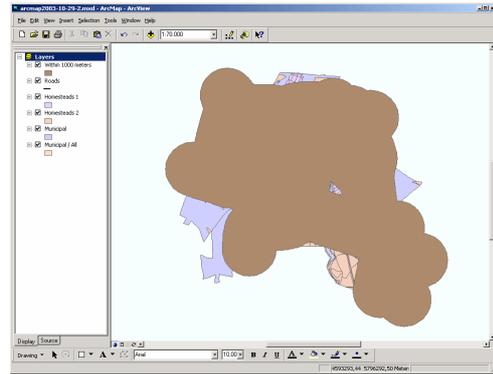
Figure 9 *Resulting buffer*

Even though Figure 9 shows the exact area that is closer than 1000 meters to a road, the visual outcome does not convince me. In my eyes, a more satisfying picture should make a clear distinction between the distances of all the homesteads, too.

What I hate most about mathematics is set theory because of its incredible high level of abstraction. However, set theory helps me this time:
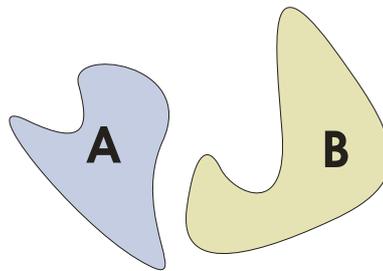
Figure 10 *Two sets A and B*
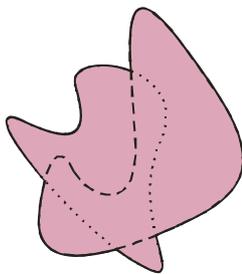
Figure 11 *A or B,*
→ *merge of A & B*
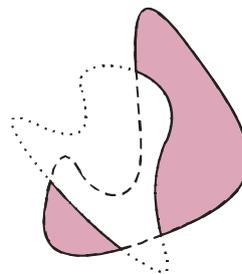
Figure 12 *B minus A*
→ *B clipped by A*
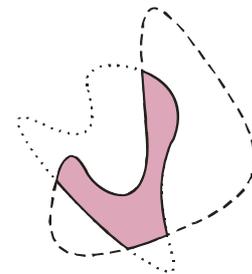
Figure 13 *A and B*
→ *anything both in A and B*

Figure 12 fits my needs if B be the homesteads and A the 1000-meter-buffer. Hence, the *Geoprocessing Wizard*, found in the *Tools* menu, created an intersection of homesteads I and the buffer plus an intersection of homesteads II and the buffer. The screenshots shown in Figure 14 and Figure 15 (see next page) underline the steps taken.
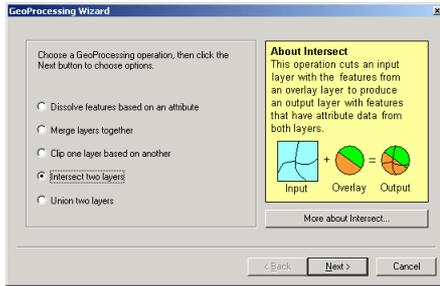
Figure 14   *Select intersection*
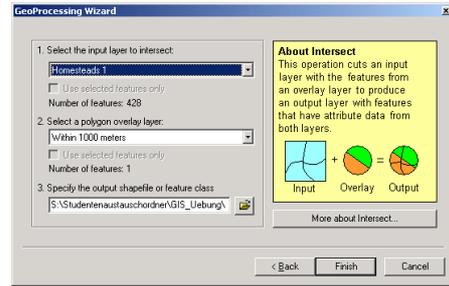
Figure 15   *Perform intersection*

In addition to both intersections, I played a bit with the colour table because I did not like the colours chosen by the software.
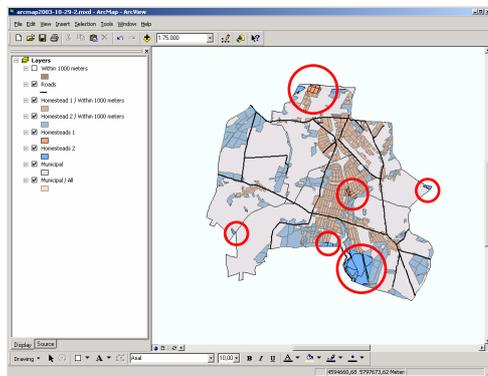
Figure 16   *All homesteads
(red circles denote homesteads >1000m)*
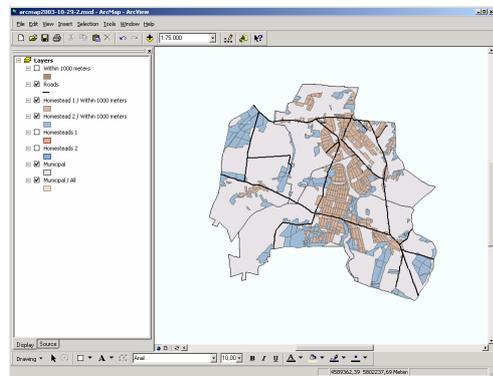
Figure 17   *Only homesteads
within 1000 m buffer*

PROBLEM 2

? *The map of Problem 1 contains 4 regions, called A, B, C and D. Shade the map's area to highlight these regions.*

At first, I tried many method like intersections, merges etc.. But a friend told me about a quite smart solution which I will present here:

There is a bunch of attributes associated to each layer exposed by *Open Attribute Table* in the context menu of the layer, e.g., the Municipal layer consists of the ones displayed in Figure 18:
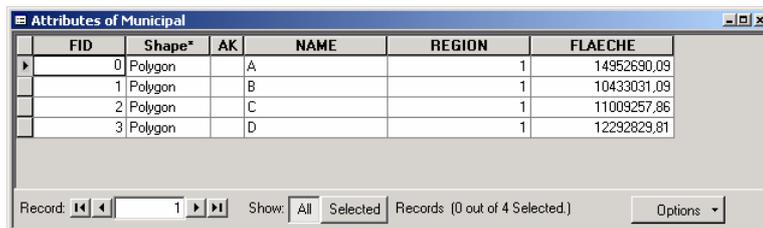
Figure 18   *Attributes of layer Municipal*

I immediately inferred from Figure 18 that I have to link attribute *Name* to some colours. The *Properties* in the context menu of the layer *Municipal* are pretty overloaded. After some time, you will find the *Symbology* tab from you should proceed to the *Categories* and then *Unique values*. Once *Name* in the *Value Field* has been selected, *Add All Values* inserts the four regions A, B, C and D into the list of available categories. I decided to overwrite the (randomly chosen ?) default colours by a greyscale. The checkbox *all other values* may be unchecked.
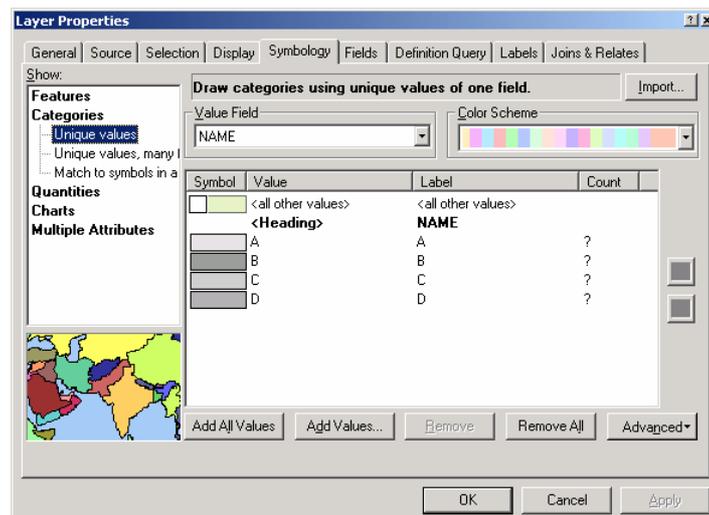

Figure 19   *Extracting the regions*

PROBLEM 3

> **?** *In addition to Problem 1 and Problem 2, .create a more satisfying map that removes **all** parts from the map not covered by the 1000 m buffer.*

Figure 9 suffered from an insufficient visualization of homesteads within the 1000 m zone. A transparency can be attached to each layer – a value of 70% seems to be rather convincing (you will find the appropriate field in the *Properties*, section *Display*, of the *Buffer* layer).
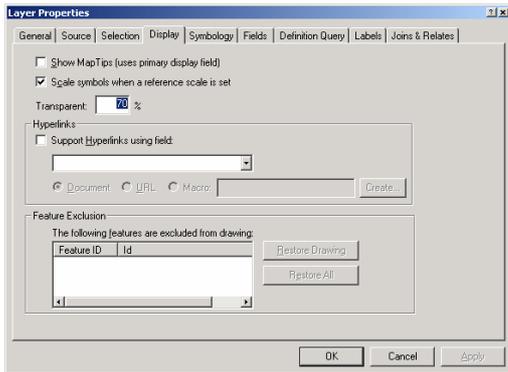
Figure 20 *Setting transparency to 70%*
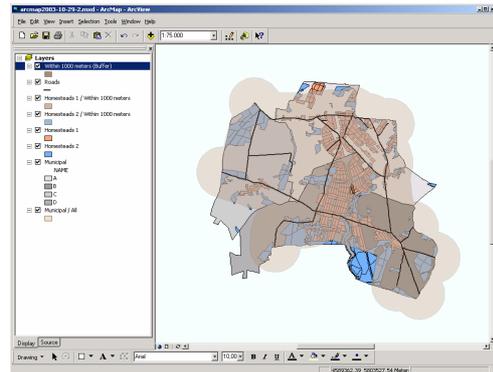
Figure 21 *Resulting image*

When intersecting the *Municipal* layer by the buffer and disabling the default *Homestead* layers, the solution looks as expected (Figure 22).


Figure 22 *Final map*