Tutorial Letter 102/1/2021

Cheese Making

YUM123C

Semester 1

Department of Silly Walks

School of Fish

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This document tests the basics of the unisatut.sty document class.

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1 INTRODUCTION

This document demonstrates some aspects of the `unisatut.cls` class file to create Unisa styled tutorial letters.

1.1 Files

The `unisatut` class consists of a number of files:

- `unisatut.cls` - the class definition
- `testunisatut.tex` - the LaTeX source for this document
- `testunisatut.pdf` - the PDF output of this document
- `unisabw.eps`, `unisabw.pdf`, `unisabw.ps` - images for use in creating the tutorial letter front page and other bits
- `unisatutpreamble.tex` - load generic/global packages and definitions to use in all tutorial letters
- `cheeseharpers.pjg` - used as an example input image in this document

1.2 Usage

Copy all the files into the same directory, or somewhere in the LaTeXpath. You can also create a separate directory for the graphic files (see `unisatutpreamble.tex` on how to set the path.)

Document class definition:

```
\documentclass[options]{unisatut}
```

Options:

- `nomathsf` - by default, the class typesets mathematics using uses a Sans Serif font. This option sets mathematics typesetting to a Serif (Roman) font.
- `solution` - this may not work properly, and has not been tested. It is a remnant from Yorick's class that uses an `assignment` environment and can include solutions.
- `online` - also a remnant from the 2012 online MOOs. To be removed in a future version.

The tutorial letter labels, such as modulecode, year, and so on, are controlled using variables defined in the document preamble. `Department` and `School` are optional, and will not appear on the front page if not defined. The LaTeX document should contain the following:

```
\documentclass[nomathsf]{unisatut}

\TutName         {Tutorial Letter}
\ModuleCode      {YUM123C}
\TutNum          {102}
\ModuleSemester  {1}
\ModuleYear      {2021}
\ModuleName      {Cheese Making}
\Department      {Silly Walks}
\School          {Fish}
\Content         {This document tests the unisatut.sty document class.}

%% INPUT pre-defined things that get used often
\input{unisatutpreamble.tex}

\begin{document}
Here be dragons!
\end{document}
```

The `unisatutpreamble.tex` file can be used to define packages that are used regularly, their settings, adjusting dimensions, and (re-)defining common commands.

2 BITS FROM THE TUT101 TEMPLATE

Here follows some bits from the standard Unisa Tut 101 template, executed in LaTeX.

Dear Student

As part of this tutorial letter, we wish to inform you that Unisa has implemented a transformation charter based on five pillars and eight dimensions. In response to this charter, we have also placed curriculum transformation high on the agenda. For your information, curriculum transformation includes the following pillars: student-centred scholarship, the pedagogical renewal of teaching and assessment practices, the scholarship of teaching and learning, and the infusion of African epistemologies and philosophies. These pillars and their principles will be integrated at both the programme and module levels, as a phased-in approach. You will notice the implementation in your modules, and we encourage you to fully embrace these changes during your studies at Unisa.

2.1 Getting started...

Given the nature of this module, you can read about it and find your study material online. Go to the website at https://my.unisa.ac.za and log in using your student number and password. You will see YUM123C in the row of modules displayed in the orange blocks at the top of the web page. Select the `More` tab if you cannot find the module you require in the blocks displayed. Then click on the module you wish to open.

We wish you every success in your studies!

3 OVERVIEW OF YUM123C

3.1 Purpose

Students who have completed this module successfully will understand more about the theoretical and practical aspects making their own cheese.

3.2 Outcomes

In this module, you will learn to do the following things:

- Describe the chemical and physical structure and properties of milk, cream, and cheese.
- Describe the genetics, physiology and biochemical processes of lactobacili.
- Learn to milk a cow.
- Learn to separate the milk into cream and whey.
- Learn to create a starter culture.
- Culture, coagulate, drain, and scald the young cheese.
- Learn patience while the mould ripens and the cheese matures.
- Appreciate the pairing of a good wine with the cheese you made.

Figure 1: Harper's cheesemaking.

The image on cheese making image in Figure 1 from https://www.abebooks.com/servlet/BookDetailsPL?bi=30630061366. The following text was liberated from Wikipedia's page on cheesemaking (https://en.wikipedia.org/wiki/Cheesemaking) to use as a filler.

One of the ancient cheesemakers' earliest tools for cheesemaking, cheese molds or strainers, can be found throughout Europe, dating back to the Bronze Age. Baskets were used to separate the cheese curds, but as technology advanced, these cheese molds would be made of wood or pottery. The cheesemakers placed the cheese curds inside of the mold, secured the mold with a lid, then added pressure to separate the whey, which would drain out from the holes in the mold. The more whey that was drained, the less moisture retained in the cheese. Less moisture meant that the cheese would be more firm. In Ireland, some cheeses ranged from a dry and hard cheese (mullahawn) to a semi-liquid cheese (millsn).

The designs and patterns were often used to decorate the cheeses and differentiate between them. Since many monastic establishments and abbeys owned their share of milk animals at the time, it was commonplace for the cheeses they produced to bear a cross in the middle.

Although the common perception of cheese today is made from cow's milk, goat's milk was actually the preferred base of ancient cheesemakers, due to the fact that goats are smaller animals than cows. This meant that goats required less food and were easier to transport and herd. Moreover, goats can breed any time of the year as opposed to sheep, who also produce milk, but mating season only came around during fall and winter.

Before the age of pasteurization, cheesemakers knew that certain cheeses can cause constipation or kidney stones, so they advised their customers to supplement these side effects by eating in moderation along with other foods and consuming walnuts, almonds, or horseradish.

4 LECTURER(S) AND CONTACT DETAILS

4.1 Lecturer(s)

You can contact the lecturer(s) using the following details:

Primary lecturer:	Prof I Knowitall
Department:	Silly Walks
Email:	inoall@unisa.ac.za

4.2 Department

You can contact the Department of Silly Walks as follows:

Telephone:	+27-12-3456789
Email:	silly@unisa.ac.za

4.3 University

To contact the university, follow the instructions in the brochure `@Unisa`. Remember to have your student number available whenever you contact Unisa. When you contact a lecturer, please include your student number to enable him/her to help you more effectively.

5 ASSESSMENT

5.1 Assessment plan

The following table is a breakdown of the formal assessment activities as they become due during the year:

Assignment	Due date	Unique number	Format
1	10 May 2021	776104	PDF
2	26 July 2021	609788	PDF
3	13 September 2021	606124	Cheese and wine tasting

Because this is an online module, the assignments are not provided in this tutorial letter. Instead, they will be posted online on `myUnisa`. Remember that only PDF format documents will be accepted. To get examination admission a yearmark of 40% is required. All assignments are compulsory.

5.2 Year mark and final examination

Your year mark for this module is calculated as follows:

- Assignment 1 contributes 30% towards the yearmark.
- Assignment 2 contributes 30% towards the yearmark.
- Assignment 3 contributes 40% towards the yearmark.
- The yearmark contributes 20% towards the final mark.
- The formal, written examination contributes 80% towards the final mark.

6 OTHER EXAMPLES

Here is a snippet from another source.

6.1 A brief summary of the k-NEAREST NEIGHBOURS algorithm

The k-NEAREST NEIGHBOURS (kNN) algorithm is one of the simplest, though widely useful, classification algorithms. It works on the principle that instances of the same class tend to cluster together. In other words, a new instance is very likely to be of the same class as those closest to it.

A target function $f : X \to Y$, is represented by a set of n instances $\langle X_i, Y_i \rangle$, where $X = \{X_1, X_2, \dots, X_n\}$ are a set of attribute values. These attribute values could be coordinates, or any combination of values that belong to a specific instance. Y_i typically represent a single class value that matches the attribute values of X_i. When a new instance $X_j = \{X_{j1}, X_{j2}, \dots, X_{jn}\}$, of unknown class has to be classified, kNN calculates the distance between X_j and each of the other instances. The k nearest neighbours are selected, and their class values counted to determine the majority class. This majority class is then assigned to the new instance X_j.

The distance measure is selected to match the data types of the instance attributes. These include the Euclidean distance, and the Manhattan distance. There are several others that are used. For example, if the attributes are coordinate values, the Euclidean distance measure works well.

The value of k is also critical to the algorithm. With $k = 1$ the new instance will be assigned the class of the nearest neighbour, which may be an outlier, and therefore not be an accurate representation of the classes. If $k = n$, the majority class value from all the instances are used, and there is no point in calculating the distances. A good heuristic value, that is often used is $k = \sqrt{n}$, or more specifically the nearest uneven integer to $\sqrt{n}$. The value of k should be uneven so that there is always a majority outcome. There are also more sophisticated methods to determine good values for k, some that use statistical methods, such as cross-validation.

An example will illustrate the workings of the algorithm. Consider the instance set in Figure 2, showing 8 instances of two classes A and B. A new instance P_9 at $(2, 1)$ has an unknown class.

Use kNN to determine the new class for C. Using the heuristic, k should be chosen as $k = 3$, but to illustrate the effect of different distance measures, use $k = 5$. In other words find the 5 nearest neighbours to C.

Use the Euclidian distance measure

$$d_{Euclidian}(p, q) = \sqrt{(p_x - q_x)^2 + (p_y - q_y)^2}$$

to calculate the distance between P_9 and the other 8 instances, and rank them according to the closest distance. The results are shown in Table 1.

With $k = 5$, the 5 closest neighbours gives 3 instances of class A and 2 instances of class B. The majority is therefore class A, hence P_9 is assigned class A. The dashed circle in Figure 2, with radius $r = 3.606$ shows the minimum Euclidian radius that encloses the 5 closest neighbours to P_9.

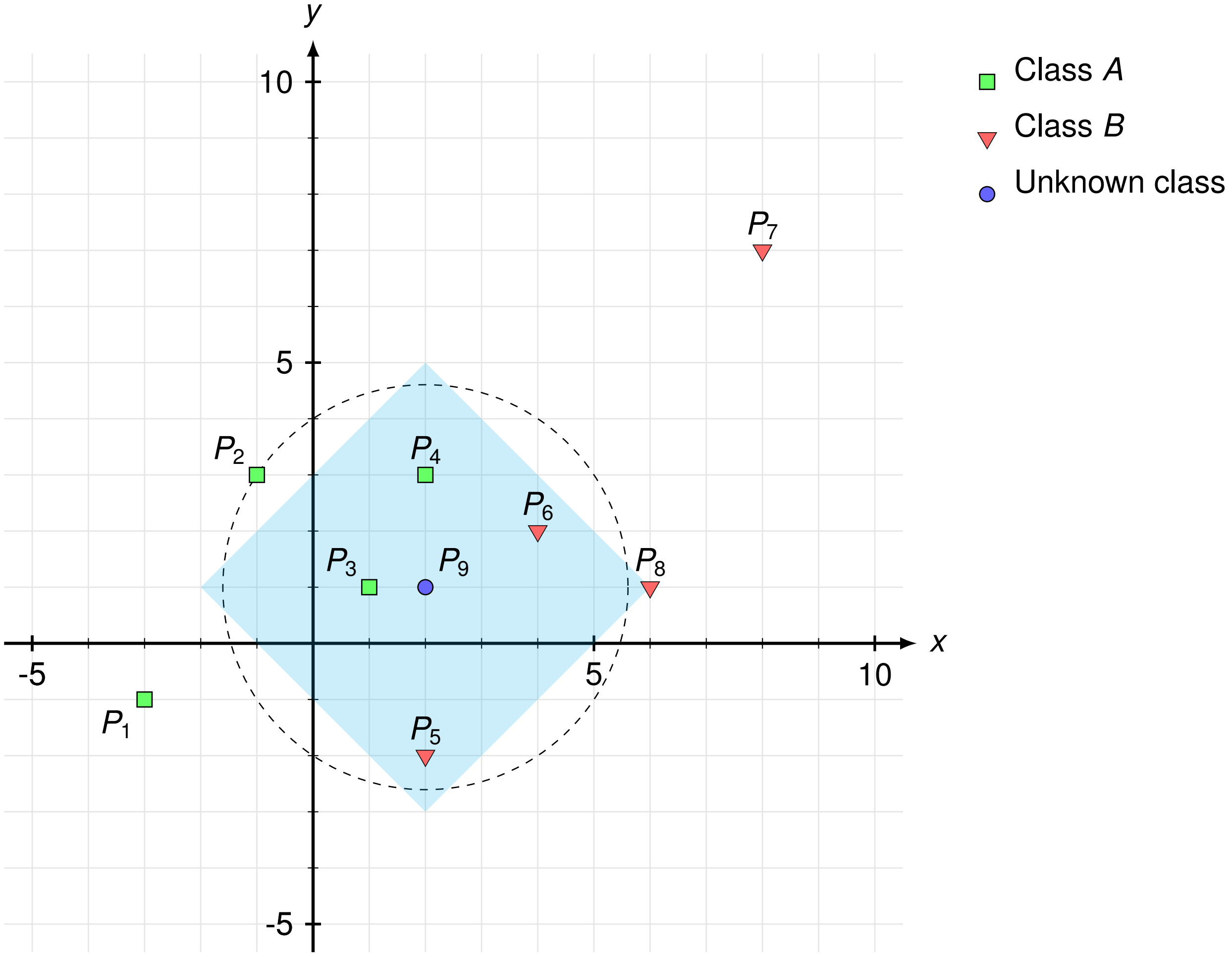

Figure 2: Instance space for kNN with two classes A and B.

instance	$d_{Euclidian}(P_9, P_i)$	class	rank
P_1	5.385	A	7
P_2	3.606	A	5
P_3	1.000	A	1
P_4	2.000	A	2
P_5	3.000	B	4
P_6	2.236	B	3
P_7	8.485	B	8
P_8	4.000	B	6

Table 1: 8 instances ranked using Euclidian distance.

Now use the Manhattan distance measure

$$d_{Manhattan}(p, q) = |p_x - q_x| + |p_y - q_y|$$

to do the same calculation. The results are shown in Table 2.

instance	$d_{Euclidian}(P_9, P_i)$	class	rank
P_1	7	A	7
P_2	5	A	6
P_3	1	A	1
P_4	2	A	2
P_5	3	B	3
P_6	3	B	4
P_7	12	B	8
P_8	4	B	5

Table 2: 8 instances ranked using Manhattan distance.

Now, the 5 closest neighbours gives a different result, with 2 instances of class A and 3 instances of class B. The majority is therefore class B, hence P_9 is assigned class B. The cyan diamond in Figure 2, with Manhattan radius $r = 4$ shows the minimum Manhattan radius that encloses the 5 closest neighbours to P_9. This illustrates the importance of choosing the correct distance measure for the data set. If x and y are simply coordinates, the Euclidian distance measure is appropriate, but if x and y represent natural numbers (say x are the number of petals on a flower, and y is the number of seed lobes), then the Manhattan distance may be a better choice.

It is often a good idea to normalise the data, so that all attributes fall within the same range, i.e. have the same scale so that distance measures can compare the attributes equally.

Total marks = 100.