**Division of Electrical and Electronic Engineering**

**Analogue and Digital Electronics**

**(4EJ500)**

**Assignment 2**

**Analogue Electronics – Digital Logic Circuit**

**Design & Simulation**

**Programme(s): BEng Electrical & Electronic Engineering**

**BSc Electrical & Electronic Engineering**

**FdEng Electrical & Electronic Engineering**

**BSc Sound, Light & Live Event Technology**

**Assessment Number: 2 of 2**

College of Engineering and Technology

**Assessment Weighting: 30% of module**

**Learning Outcomes Assessed: 2**

###### Week Set: 11th March 2019

**Submission Date: 3rd May 2019**

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**MS225**

**X3202**



## Design Problem

A display driver Integrated Circuit (IC) for a seven-segment LCD display can be seen below in Figure 1.

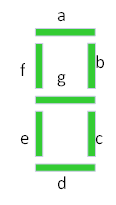


Figure 1 – 7 segment display driver IC

Using the truth table, in Table 1, it is possible to model this system using digital logic gates.

The assignment task is as follows:

1. Derive the Boolean expression for the output ‘**e**’ in terms of its sum of products (SoP).
2. Further simplify this expression without the use of K maps.
3. Make up this circuit using logic gates in Multisim and simulate it to obtain a truth-table proving correct operation.
4. Find the SoP simplification of the circuit using a K-Map.
   * Implement this circuit in Multisim and simulate to verify that it is correct.
5. Find the Product of Sums (PoS) simplification using a K-Map.
   * Implement this circuit in Multisim and simulate to verify that it is correct.
6. Comment on how each circuit has simplified and whether the solution using SoP or PoS is simpler.
7. Derive the NOR equivalent circuit of your best simplification from parts 4 and 5 above and simulate it in Multisim to show correct operation.



|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **A** | **B** | **C** | **D** | **a** | **b** | **c** | **d** | **e** | **f** | **g** | Display |
| **0** | **0** | **0** | **0** | 1 | 1 | 1 | 1 | **1** | 1 | 0 | “0” |
| **0** | **0** | **0** | **1** | 0 | 1 | 1 | 0 | **0** | 0 | 0 | “1” |
| **0** | **0** | **1** | **0** | 1 | 1 | 0 | 1 | **1** | 0 | 1 | “2” |
| **0** | **0** | **1** | **1** | 1 | 1 | 1 | 1 | **0** | 0 | 1 | “3” |
| **0** | **1** | **0** | **0** | 0 | 1 | 1 | 0 | **0** | 1 | 1 | “4” |
| **0** | **1** | **0** | **1** | 1 | 0 | 1 | 1 | **0** | 1 | 1 | “5” |
| **0** | **1** | **1** | **0** | 1 | 0 | 1 | 1 | **1** | 1 | 1 | “6” |
| **0** | **1** | **1** | **1** | 1 | 1 | 1 | 0 | **0** | 0 | 0 | “7” |
| **1** | **0** | **0** | **0** | 1 | 1 | 1 | 1 | **1** | 1 | 1 | “8” |
| **1** | **0** | **0** | **1** | 1 | 1 | 1 | 1 | **0** | 1 | 1 | “9” |

Table 1 – Truth table for 4 input, 7 output display driver IC

**The marking will be based on the following rubric**



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| --- |
| **USEFUL MATERIALS** |
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**Assessment Regulations for Undergraduate Programmes**

**Further reference to the University assessment regulations can be found at:**

<https://www.derby.ac.uk/about/academic-regulations/>

Undergraduate marking scale

|  |  |
| --- | --- |
| This scale applies to Levels 3, 4, 5 and 6 in the University Credit Framework. The descriptors are typical characteristics of the standard of work associated with each range of marks. The descriptors are illustrative and for guidance only. They are not comprehensive. A mark of 40% is regarded as a minimum pass. |  |

Please see the assessment grid overleaf to see how the marks will be apportioned for this assignment.

|  |  |  |
| --- | --- | --- |
| **% mark** | **Mark Descriptors** | Class |
| **70-100%** | **Excellent**  Outstanding; high to very high standard; a high level of critical analysis and evaluation, incisive original thinking; commendable originality; exceptionally well researched; high quality presentation; exceptional clarity of ideas; excellent coherence and logic. Trivial or very minor errors. For the highest marks (90 - 100%): an exceptional standard of work illustrating thorough and in-depth understanding, communicated with exceptional authority.  **First** | First |
| **60-69%** | **Very good**  A very good standard; a very good level of critical analysis and evaluation; significant originality; well researched; a very good standard of presentation; commendable clarity of ideas; thoughtful and effective presentation; very good sense of coherence and logic; minor errors only. | Second Div1 |
| **50-59%** | **Good**  A good standard; a fairly good level of critical analysis and evaluation; some evidence of original thinking or originality; quite well researched; a good standard of presentation; ideas generally clear and coherent, some evidence of misunderstandings; some deficiencies in presentation. | Second  Div 2 |
| **40-49%** | **Satisfactory**  A sound standard of work; a fair level of critical analysis and evaluation; little evidence of original thinking or originality; adequately researched; a sound standard of presentation; ideas fairly clear and coherent, some significant misunderstandings and errors; some weakness in style or presentation but satisfactory overall.  **Third** | Third |
| **35-39%** | **Unsatisfactory**  Overall marginally unsatisfactory; some sound aspects but some of the following weaknesses are evident; inadequate critical analysis and evaluation; little evidence of originality; not well researched; standard of presentation unacceptable; ideas unclear and incoherent; some significant errors and misunderstandings. Marginal fail. | Marginal  Fail |
| **21-34%** | **Poor**  Below the pass standard; a poor critical analysis and evaluation; virtually no evidence of originality; poorly researched; presentation unacceptable and not up to graduate standard; ideas confused and incoherent, some serious misunderstandings and errors. A clear fail, short of pass standard. |  |
| **1-20%** | **Very poor**  Well below the pass standard, with many serious errors. Standard of presentation totally unacceptable, incoherent and may be severely under- length. No evidence of evaluation or application. A very clear fail, well short of the pass standard. | Fail |
| **NS** | **Non-submission**  No work has been submitted. |  |
| **Z** | **Academic offence notation**  **Applies to proven instances of academic offence.** |  |

**ETHICS, PLAGIARISM and ACADEMIC OFFENCES**

Your attention is drawn to the fact that work submitted in this module must be your own individual work, with all materials from other sources correctly referenced.

For further guidance refer to the University Study Skills guidance on ***Referencing and Citation***, found at:

<http://www.derby.ac.uk/library/study-skills/citing-and-referencing>

For further general information refer to the University’s 3R’s at:

<http://www.derby.ac.uk/academic-regulations>

**PLAGIARISM**

An “academic offence” is committed when a student tries to gain improper advantage for her/himself, or not following the Academic Regulations, concerning any part of the assessment process. Further information can be found at:

<https://www.derby.ac.uk/media/derbyacuk/assets/departments/the-registry/academic-regulations-2018-aug/Part-J-Academic-Offences-2018-19.pdf>

**ELECTRONIC SUBMISSION GUIDE**

You’ll find an electronic assignment submission area in Course Resources in UDo.

This document gives **general advice** to you as students on how to use this feature. There may be some programmes and modules where this feature is used slightly differently. Your lecturers will inform and advise you if this is the case.

Further guidelines on using the electronic submission system can be found on:[UDo](https://portal.ombiel.co.uk/assets/UniversityofDerby/UniversityofDerby/UDO/UDO-Student-Centre-Images/PDFs/How-to-submit-your-assignment-online.pdf)

Below are general notes for all students for electronic submission:

#### Deadlines

* Your deadline is 9.00 pm on **3rd May 2019**. I do however; advise you submit earlier than the deadline as part of managing your workload and to take advantage of the plagiarism checking function prior to your final submission.
* The electronic submission area will continue to accept work after the due date – please note the date and time of submission will be recorded to identify late submissions.
* Submitting your assignment AFTER the assignment deadline will immediately incur a FAIL
* Your assignment must be submitted as **one single file**. Don’t split your assignment, bibliography or appendix items into separate documents.
* Your submitted file must be **less than 20 MB** in size. You’ll find advice on [UDo](http://www.derby.ac.uk/esub) on some easy ways to reduce file sizes.
* Assignments may be in **MS Word, WordPerfect, PostScript, PDF, HTML, RTF** or **plain text** format.

#### Submitting

* **Remember**: **assignment submission is a two-step process.**

1. First you select your file and click **UPLOAD**.
2. Then, after viewing the basic preview of your assignment, you must click **SUBMIT**. Your assignment is not submitted until you have done so and email confirmation received.

* **Preview your assignment**: on clicking UPLOAD a preview of your assignment will be displayed. This is a text-only preview and will not show footnotes, illustrations and formatting, so don’t worry if it looks like basic text. Its purpose is to allow you to check the correct file has been selected for upload and that it hasn’t been corrupted during the submission process. The preview is purely an indication for you; the tutor will receive the fully formatted version for marking.
* **It is your responsibility to check the work you’ve submitted is the correct piece of work and it’s not corrupted** – the work you submit will be the work that is marked; you’ll be asked to acknowledge this as part of the submission process.
* **Confirmation of successful submission** will be provided by an automatic email delivered to your student email address. This is your proof of submission - do not delete this email. **If you don’t receive this receipt**, go into Course Resources and look for and at your submitted file. If you cannot see any submitted file, your submission may not have been successful and you should attempt to resubmit. Advice on the confirmation process, how to view your submitted work and what to do if your submission is still not accepted, can be found at [UDo](https://portal.ombiel.co.uk/assets/UniversityofDerby/UniversityofDerby/UDO/UDO-Student-Centre-Images/PDFs/How-to-submit-your-assignment-online.pdf)

**Resubmitting** **Assignments**

* **Before the assignments deadline** has passed submitted assignments are considered draft and can be resubmitted/overwritten repeatedly. To resubmit work click the resubmit button from the assignment submission screen. We recommend you submit early to take advantage of the plagiarism detection tool and then amend and resubmit if you can further enhance and improve your work. You don’t need to resubmit if you’re happy with your first submission; your draft version will become your actual submission.
* **After the assignment deadline** assignments cannot be resubmitted.
* If all attempts to submit your assignment via Course Resources fail, in the first instance visit [UDo](https://portal.ombiel.co.uk/assets/UniversityofDerby/UniversityofDerby/UDO/UDO-Student-Centre-Images/PDFs/How-to-submit-your-assignment-online.pdf) for advice and guidance.

**What happens if the Submission System is down?**

* If the system is down, we’ll be aware of this and communicate widely to you via Course Resources and UDo.
* You’ll receive notification the system is down and be asked to stop submitting work.
* Once the system is back online you’ll be advised to start submitting and an appropriate extension will be given.
* If you’ve not received official notification that the system is down and you experience problems you must contact an [IT helpdesk](https://itservicecentre.derby.ac.uk/hc/en-us) to seek support in the first instance.

#### Difficulties

1. If you’re having difficulties accessing Course Resources, your course, or your assignment screen, go to [UDo](http://www.derby.ac.uk/esub) or one of the IT helpdesks situated in the library. During peak submission points there will be submission clinics on all sites staffed by fellow students who will be able to help you.
2. If you have a condition that would make it difficult to submit online, please contact your Module Leader to seek additional student support.

Sketches will have to be scanned or photographed and submitted with the work.

To help you with the e-submission process refer to following web page [UDo](http://www.derby.ac.uk/esub)

For help with learning resources, books and journals ask Sally Forrest (Subject Advisor: College of Engineering and Technology) or other librarians at the Britannia Mill Library

Email [s.forrest@derby.ac.uk](mailto:s.forrest@derby.ac.uk). Library (L103), Tel 01332 591203