COMP1549 (2019/2020)	**Advanced Programming Coursework**	**Contribution 50% of course**
Course Leader: Dr Muhammad Taimoor Khan	**Faculty Header ID: 300919**	**Deadline Date March 13th, 2020**

Plagiarism is presenting somebody else's work as your own. It includes: copying information directly from the Web or books without referencing the material; submitting joint coursework as an individual effort; copying another student's coursework; stealing coursework from another student and submitting it as your own work. Suspected plagiarism will be investigated and if found to have occurred will be dealt with according to the procedures set down by the University. Please see your student handbook for further details of what is/isn't plagiarism.

All material copied or amended from any source (e.g. internet, books) must be referenced correctly according to the Harvard reference style.

Your work will be submitted for plagiarism checking. Any attempt to bypass our plagiarism detection systems will be treated as a severe Assessment Offence.

Coursework Submission Requirements

- **An electronic copy of your work for this coursework must be fully uploaded by midnight on or before the Deadline Date.**
- **For this coursework you must submit a single ZIP file.**
- **Make sure that any files you upload are virus-free and NOT protected by a password or corrupted otherwise they will be treated as null submissions.**
- **Your work will not be printed in colour. Please ensure that any pages with colour are acceptable when printed in Black and White.**

Coursework Regulations

1. **If you have Extenuating Circumstances you may submit your coursework up to two weeks after the published deadline without penalty but this is subject to acceptance of your claim by the Faculty Extenuating Circumstances Panel.**
2. **Late submissions will be dealt with in accordance with University Regulations.**
3. **Coursework submitted more than two weeks late may be given feedback but will be recorded as a non-submission regardless of any extenuating circumstances.**
4. **Do not ask the lecturers for extensions to published deadlines - they are not authorised to award an extension.**
5. **The coursework must be submitted as above. Under no circumstances can they be accepted by academic staff.**

Please refer to the University Portal for further detail regarding the University Academic Regulations concerning Extenuating Circumstances claims.

DETAILED SPECIFICATION

This coursework contributes to 50% of your final grade of this module. This coursework can be submitted **either individually or in a group of up to 4 students**. The coursework will include the submission and evaluation of the following two elements:

- project source code [**70 marks**]
- project report [**30 marks**]

The coursework should be submitted **as a single ZIP** file that contains "**src**" folder of project implementation and a **PDF** of the project report.

The assessment of the coursework report will be based on its completeness, correctness, readability and conformance to the expected format. While the assessment of the source code will be based on the evaluation and testing of your code against the detailed technical tasks listed in the next section of the document.

Coursework Task

The aim of the coursework is to implement a networked distributed system for a group-based communication, which conforms with the following requirements. All members know of all other members. When a new member joins (connects), he/she has to provide following parameters as an input (i.e., command-line parameters):

1. an ID number (please ensure that each member is assigned a unique ID number),
2. a port it will listen to, and
3. a port and IP number of one of existing members.

If a member is the first one, the member has to be informed about it at start-up. Then this member will become the coordinator.

The new members will then contact the old members and the old members will tell it everyone's IDs, IP addresses and ports including the IP address, port and ID of the current group coordinator. After this, the new member will contact everyone to let them know that they can add it to the set of members. In case some of the members do not respond, it will inform all the other member about this, and the other members can update their list of existing members. However, if the coordinator does not respond, then any new member can be a coordinator.

Importantly, the module that implements members does not need to accept input from keyboard after they have got the starting parameters, but they should print out information about the various information shared to/by the member. Any member can quit by a simple ctrl-C command.

Furthermore, all members sign their messages digitally, and all message signatures are checked. All keys are stored in a Java key-store file, a copy of which all programs have in their working directory. This also means that you have a predefined set of participants (for instance, maximum of 20 participants) for which you have created a key in the key-store file. For further details about the technical background required for the task, please see lecture material or ask instructors.

The project implementation **must demonstrate the following programming principles and practices, which contribute directly to the final grade**:

- Modularity using design patterns
- JUnit based testing of the application
- Fault tolerance
- Component based development

Assessment guidelines

Admin details. The assessment of the project report is based on the overall technical quality, relevancy and completeness, contributions and the details in supporting your solution and implementation. While the assessment of the project implementation is purely based on the correct implementation of technical requirements (as described in Coursework Task) and its adherence to various principles (as stated in Coursework Task).

For project implementation, breakdown of the marks is as follows:

- The project should demonstrate the following programming principles and practices:
  - Group formation, connection and communication [10 marks]
    - A group should be correctly formed connecting with all members where all members can communicate without any error.
  - Group state maintenance [10 marks]
    - The state of the group must be maintained correctly. This includes recording of the messages exchanged among members of the group with timestamps.
  - Coordinator selection [10 marks]
    - A correct implementation to automatically choose the coordinator even when the existing coordinator is disrupted/disconnected abnormally.
  - Use of design patterns [10 marks]
    - Adequate use of various design patterns in the implementation of the project.
  - Fault tolerance [10 marks]
    - Adequate strategy implementation for the fault tolerance. In particular, when a member terminates abnormally or when a coordinator terminates abnormally.
  - JUnit based testing of the application [10 marks]
    - Desired testing for implementation of all of the main requirements.
  - Use of component-based development [10 marks]
    - Adequate design and development of components in the implementation.

For project report, you are asked to adhere ALL of the following rules:

- The report should be written using Arial font size 11.
- The paper length should not exceed **5 pages double-column** according to the template (loosely based on the IEEE paper format), which can be seen on the next page. This is an upper limit to give you the flexibility to write an appropriate paper.
- The table of content of the report should include the following sections:
  - Introduction [10%]
    - This section should be a brief explanation to what the coursework is about, what you did for the coursework, and how your report is organized.
  - Design/Implementation [40%]

    - This section should explain how you implemented each technical requirement. You should also brief the environment did you used for the implementation. You may use visuals (e.g., UML) to describe the design of implementation. Importantly, you should justify the implementation choices.
- Analysis and Critical Discussion [30%]
    - This section should explain the results for running the code of all technical tasks. You should also explain how you achieved modularity, fault tolerance and should also explain design-by-contract annotations of the annotated module. Importantly, you should state limitations or weaknesses of your implementation choices.
- Conclusions [10%]
    - The conclusion based on analysis and implementation.
- Presentation style [10%]
    - The presentation includes structure and contents of the report. The contents of the report should be adequate supported by reasonable justification.
- Appendix [optional, 0%]
    - This can be used to give more source code, examples and figures. There is no page limit for the appendix. However, please note that the appendix is not marked, although the marker(s) may refer to it to understand more about what you have done.

Note: There is a 20% penalty if the paper does not abide by all above rules.

Assessment criteria for technical task (i.e., implementation)

The following criteria will be used when marking the project implementation

Grade	Description
Implementation: [100%]	
0%-39%:	Inadequate or missing implementation of the main given technical requirements. Inappropriate or missing implementation of all of the required features, i.e., modularity, fault tolerance and design-by-contract annotations.
40%-49%:	Inadequate or missing implementation of most of the given technical requirements. Inappropriate or missing implementation of most of the required features, i.e., modularity, fault tolerance and design-by-contract annotations.
50%-59%:	Inadequate or missing implementation of some of the given technical requirements including some key requirements. Inappropriate or missing implementation of some of the required features, i.e., modularity, fault tolerance and design-by-contract annotations.
60%-69%:	Inadequate or missing implementation of couple of the given technical requirements but that does not include key requirements. Inappropriate or missing implementation of one of the required features, i.e., modularity, fault tolerance and design-by-contract annotations.
70%-79%:	Adequate implementation of all of the given technical requirements including the key requirements. Appropriate implementation of all of the required features, i.e., modularity, fault tolerance and design-by-contract annotations for at most couple of modules.
80%-100%:	Outstanding implementation of all of the given technical requirements including the key requirements. Outstanding implementation of all of the required features, i.e., modularity, fault tolerance and design-by-contract annotations for more than one modules.

Assessment criteria for project documentation (i.e., report)

The following criteria will be used when marking the project report

Grade	Description
Introduction: [10%]	
0%-39%:	Lack of coherent explanation of the structure of the report and design of the implementation.
40%-49%:	Inadequate explanation of the structure of the report and design of the implementation.
50%-59%:	Good explanation of the structure of the report and design of the implementation with some missing details and/or with some inconsistencies.
60%-69%:	Good explanation of the structure of the report and design of the implementation with few missing details and/or with few inconsistencies.
70%-79%:	Very good explanation of the structure of the report and design of the implementation with no missing details and/or inconsistencies.
80%-100%:	Outstanding explanation of the structure of the report and design of the implementation with no missing details and/or inconsistencies. Justified description of the report structure and design technical details.
Design/implementation: [40%]	
0%-39%:	Little or no explanation of technical details of the implementation
40%-49%:	Inadequate explanation of technical details of the implementation
50%-59%:	Good explanation of technical details of the implementation
60%-69%:	Good explanation of technical details of the implementation based on logical structure with justification of some implementation choices
70%-79%:	Very good explanation of technical details of the implementation based on logical structure with justification of most of the implementation choices
80%-100%:	Outstanding explanation of technical details of the implementation based on logical structure with justification of all of the implementation choices
Analysis and Critical Discussion: [30%]	
0%-39%:	Little to no evidence of analysis. No critical discussion or limitations of the implementation.
40%-49%:	Little evidence of analysis. Hardly any critical discussion or limitations of the topic.
50%-59%:	Evidence of some analysis. Demonstrated basic technical awareness in critical discussion or limitations of the implementation choices.
60%-69%:	Good evidence of analysis. Satisfactory critical discussion and limitations of the implementation choices.
70%-79%:	Extensive evidence of analysis. Excellent critical discussion and limitations of the implementation choices.
80%-100%:	Extensive evidence of analysis. Excellent critical discussion and limitations of the implementation choices. Demonstrated innovation in design and implementation choices.
Conclusions: [10%]	
0%-39%:	Poor or missing conclusion of the report.
40%-49%:	Limited conclusion of the report.
50%-59%:	Almost complete conclusion of the report and what it has been achieved in terms of analysis and discussion.
60%-69%:	Complete conclusion of the report and what it has been achieved in terms of analysis and discussion. But it seems more like reporting the various points rather than having some critical view.
70%-79%:	Very good conclusion of the paper. Clear link between analysis and critical view of the implementation.
80%-100%:	Excellent conclusion of the paper. Demonstrate thoroughness in linking analysis and discussion with what is implemented. Carefully crafted critical view of the implementation.
Presentation style: [10%]	
0%-39%:	Very poor presentation and structure. Unsatisfactory presentation: significant grammatical or spelling errors. Writing style lacking any coherence. Missing references.
40%-49%:	Poor presentation and structure. Unsatisfactory presentation: significant grammatical or spelling errors. Writing style difficult to follow. Limited attempt at providing references

50%-59%:	Orderly presentation and structure. Adequately presented: some grammatical and spelling errors. Writing style sometimes awkward. Inconsistent referencing and bibliographic formatting.
60%-69%:	Clear presentation, logically structured, with few shortcomings. Well presented: minimal significant grammatical or spelling errors if any. Written in a logical style. Fairly consistent referencing and bibliographic formatting.
70%-79%:	Good presentation, logically structured. Very well presented: minimal grammatical or spelling errors if any. Written in a fluent and engaging style. Consistent referencing and bibliographic formatting.
80%-100%:	Excellent presentation, logically structured, and well explained. Exceptionally well presented: no grammatical or spelling errors. Written in a fluent and engaging style. Exemplary and consistent referencing and bibliographic formatting

Title

Author 1 name and author 2 name

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***Abstract*—This is a very brief summary of the work produced, including a brief explanation of the topic and key results. This is the first piece of text that the reader will see. So, make sure it is well-written. A good length is one or two paragraphs. It is worth 5% of the report.**

Key words: *(keyword 1, keyword 2, keyword 3, keyword 4; choose four relevant keywords or terms that characterize the topic of your choice)*

I. Introduction

Here, you describe the motivation and rationale behind the specific topic. What makes the particular area interesting or important, where is it used in the real world, and why does it make sense to measure the particular performance metrics that you have chosen. Use this space to set the scene for the rest of your paper.

Note that it is important to follow this template from the beginning to the end. Do not change fonts (Times New Roman 11), sizes or anything else.

Unlike the next section (related work), it is OK here to cite non-academic publications, such as relevant announcements from the government, news items etc.

The introduction is worth 10% of the report.

Note that the whole paper needs to be precisely 5 pages. If you exceed the 5-page limit you will lose marks.

II. Design/implementation

Also known as "design" of your implementation, this is among the most important aspects of the paper. Here, you need to explain what salient features of your solution design and implementation are.

And so on…

The related work section is worth 40% of the report.

III. Analysis and Critical Discussion

This section will be the core part of the report, which will state all the analysis and arguments of the investigated aspect.

The analysis and discussion section is worth 30% of the report.

IV. Conclusions

Here, you briefly summarise the work carried out and suggest possible future work. The conclusions section is similar to the abstract with the addition of the future work suggestion or perhaps more detail in the summarization of the results of the previous section.

The Conclusions section is worth 10% of the report.

Acknowledgement

This is an optional section, where, if you want, you can thank colleagues or family that helped you or supported you in relation to this particular paper.

References

[List and number all references used in this paper following the Harvard Referencing style. It is not terribly important whether in each reference you place the issue number, page, publisher etc. What matters is that you are consistent and you use precisely the same format in all your references.

An example list of references following the Harvard referencing style is shown below. Note the appropriate use of italics:]

Young, H.D., Freedman, R.A., Sandin, T. and Ford, A. (2000) *Sears and Zemansky's university physics*. 10th edn. San Francisco: Addison-Wesley.

Bell, J. (2005) *Doing your research project*. 4th edn. Maidenhead: Open University Press.

Jackson, G. (2000) 'Ports 1700-1840', in Clark, P. (ed.) *Cambridge urban history of Britain: Vol. 2 1540-1840*. Cambridge: Cambridge University Press, pp. 705-731.

Cook, D. (2000) 'Developing franchised business in Scotland', *Small firms: adding the spark: the 23rd ISBA national small firms policy and research conference*. Robert Gordon University, Aberdeen 15-17 November. Leeds: Institute for Small Business Affairs, pp. 127-13