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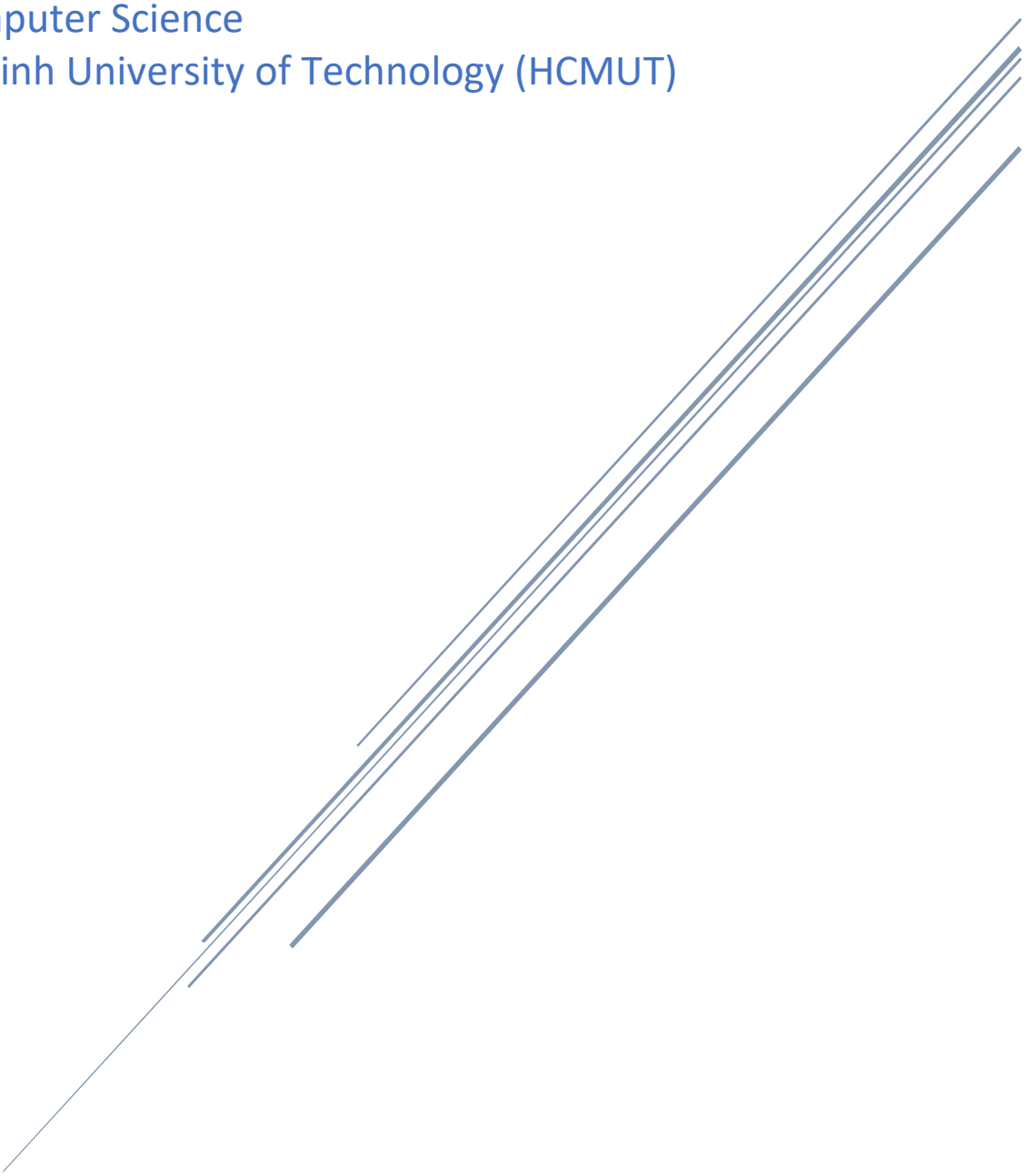
BRITISH COUNCIL

OBJECTIVE 2 – QUALIFICATION BENCHMARKING REPORT

MSc Computer Science
Ho Chi Minh University of Technology (HCMUT)



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Introduction

The Master's programme in Computer Science at the Faculty of Computer Science and Engineering, Ho Chi Minh City University of Technology (HCMUT), VNU-HCM, provides fundamental knowledge in Computer Science and specialized majors such as Data Science, Network Security, and Software Engineering.

For this benchmarking exercise we have developed a scoring matrix where we identified 5 themes (programming, knowledge management, knowledge abstraction, knowledge representation/communication and research/soft skills). **Programming** theme entails criteria related to design and development of not only software but also other artefacts like algorithms, network, IoT framework etc. The theme also includes the evaluation process and collaborative management of the artefacts. **Knowledge management** primarily focuses on processes and techniques of warehousing different types of data. The theme also includes security and privacy issues related to data management. **Knowledge abstraction** theme focuses on different data analytics and machine learning techniques applied to different types of data. **Knowledge representation/communication** theme includes different visualisation techniques used to represent the results (from database query through to data analytics to algorithm) to a wide range of stakeholders. **Research/Soft skills** theme focuses on the understanding and practice of research methods along with the ability to undertake team work and present results to a wider audience.

Within each theme, we have a set list of criteria against which each course is scored. The score is within the range of 50 – 100. 90 – 100 (fully meets the criteria); 75 – 89 (mostly meets the criteria); 60 – 74 (partially meets the criteria); 50 – 59 (barely meets the criteria). The marks are indeed subjective and therefore debatable. However the pattern that emerges as a result of the scoring of each module/course provides a holistic view of the programme and clearly identifies the areas of strengths and improvements.

Design of the programme

1. The programme has three pathways – Applied, Research and Research Intensive pathways based on the emphasis on research related courses and activities students undertake.
2. Within the Applied and Research pathways, students can specialise in Computer Science, Cyber Security, Data Science or Software Engineering. The Research Intense programme primarily focuses on scientific thesis and reports (54/60 credits).
3. The programme has 36 courses/modules primarily due to the number of pathways and number of specialisation options.
4. The courses/modules focus on specialised skills for programming, knowledge abstraction and research/soft skills. There is less emphasis on data representation aspects.
5. The programme is comprised of 60 Vietnamese credits.

Mode of Delivery

6. All courses are delivered in English and have theory, practice and self-study credit hours. From the course structure document, we could not identify any course with allocated self-directed study time.

7. Most of the courses have some degree of soft skill development elements like group presentation, project development. However, the assessments are primarily exam focused.
8. From the documents provided, it is not clear how the theory part of each course is delivered and whether it is lecture only, mix of lectures and discussions, group discussion etc. For some general courses like Philosophy, group discussion or case study is more effective than lecture only.
9. For practical sessions, information regarding class size and available resources is necessary to evaluate the effectiveness of the practical sessions.

Learning and Teaching

10. The programme covers a wide range of topics with its 36 courses/modules. This is primarily due to the pathways and specialisation options offered.
11. Most of the courses have group projects and presentations, which enable students to enhance their research/soft skills.
12. One third of the courses/modules focus on different types and aspects of programming. Given the specialisations in computer/data/cyber/software engineering such a wide range of offering is understandable. However, delivering such a wide range of courses requires resources and may impact module quality. Therefore, combining some modules would benefit the students as well as staff, in-terms of resources and quality.
13. More than one third of the courses/modules focus on data abstraction. Most of these courses provide detailed understanding about the algorithms/intelligent agents, however ethics issues related to these algorithms are not covered by the courses.
14. Only two modules (Big Data, Data Engineering) cover the data management theme, despite the fact that data management is an important part of data and computer science. Data pre-processing and quality assurance underpins the efficiency and effectiveness of data analytics and machine learning techniques applied to abstract knowledge from the data.
15. Visualisation and communication theme is missing from the programme (except two modules – Comm for Soft. Eng., Prog Foundation for Data Analyst).
16. Critical understanding about code sharing (github etc.) seems to be missing. For a data science programme it is important that students are aware and have experience of code sharing, documentation and different licenses used for open-source software/algorithm development.
17. Some of the reference materials are outdated.
18. Overall, most of the courses are theory based and assessments are exam based. This can be improved by introducing more case studies and/or application of the algorithm/application in real life scenarios. In these approaches students would gain more experience of application of the appropriate algorithm in the right context.

Assessment and Feedback

19. No information was available with regard to assessment or exam samples.
20. No information was provided as to how student feedback is captured, evaluated and utilised for the improvement of the courses.

Conclusion and Recommendations

1. Teaching modality
   a. More discussion-based teaching approach including flip classroom type teaching model can be introduced to increase student engagement and self-directed study.
   b. Project-based learning approach can be implemented to get more knowledge about different real-life projects, their short comings etc.
2. Teaching content
   a. Low code/No code based programming are becoming popular (10.3390/electronics10101192) in universities with the rise of online education and as a result of COVID-19. Adaptation with this new trend will help students to develop new applications/algorithms more easily. This impacts not only skill development but confidence also.
   b. In this regard API based programming e.g. GPT-3 like language model (from OpenAI etc.) to any software/app would benefit students with high quality trained dataset/model integration.
   c. Analysis of real-life data from different domains (finance, healthcare, social media etc.) is essential to get understanding about different data sources and types.
   d. Engagement with stakeholders and requirement capture is pivotal. Therefore, with different types of programming/machine learning courses these aspect needs to be included.
   e. Use of online content/courses can introduce students to new topics and choice of learning sources (in contrast to recommended books). This diversity of content and modality of delivery not only helps students to be in line with current trends but also initiates peer learning.
   f. Skill development on code sharing (through github etc.) and open licence needs to added to the course curriculum along with collaborative code development (e.g. Google Colab, AWS).
   g. Cyber security aspect of software/algorithm design and development can be improved by incorporating some topics from cyber security, particularly access control to source code and sensitive data (e.g. health data).
   h. Basic understanding of how to protect intellectual property rights related to algorithms and the process of protecting these rights through third party.
   i. Critical understanding of research methods in higher education and steps involved from idea generation through to publication and/or application can be incorporated.
   j. More emphasis can be given to data communication. This can be given by group presentations, peer assessments etc.
   k. Basic knowledge of social media-based profile creation e.g. LinkedIn profile that will facilitate future job prospects.
3. Assessment
   a. More emphasis on project-based assessments (instead of exams) would help students to get experience of team work and other aspects of project management.


CRITERIA
MATHEMATICAL FOUNDATION FOR COMPUTE
ADVANCED SYSTEM ARCHITECTURES
SECURITY IN MODERN COMPUTING PLATFOR
COMMUNICATION FOR SOFTWARE ENGINEEF
MODERN APPROACHES FOR SPEECH PROCE
MODERN APPROACHES FOR NATURAL LANGI
DEEP LEARNING AND ITS APPLICATIONS IN C
MALWARE ANALYSIS
SOFTWARE TESTING
CUSTOM SOFTWARE ENGINEERING FOR SM
SOFTWARE SECURITY
SOFTWARE ARCHITECTURE
IOT APPLICATION DEVELOPMENT
ANALYSIS OF SOFTWARE ARTIFACTS
EXPERIMENT DESIGN AND ANALYSIS
EMBEDDED SYSTEM DESIGN
NEW TRENDS IN ICT
PROGRAMMING FOUNDATION FOR DATA ANA
MACHINE LEARNING AND APPLICATIONS
DATA ENGINEERING
APPLIED CRYPTOGRAPHY
LAWS, POLICIES AND STANDARDS IN CYBER-
DATABASE SECURITY
NEW GEN SOFTWARE ENGINEERING
NETWORK SECURITY
BIG DATA
PARALLEL COMPUTING
REAL-TIME SYSTEMS
PROGRAM ANALYSIS
HARDWARE DESIGN METHODOLOGIES
NATURAL LANGUAGE PROCESSING
RECONFIGURABLE SYSTEM COMPUTING
LOGIC AND CONSTRAINT PROGRAMMING
INTELLIGENT SYSTEMS
DATA MINING
ADVANCED ALGORITHMS
PROGRAMMING
General knowledge on different software/algorithm, their application, strenghts and limitations.
Knowledge and skill to undertake requirement analysis.
Ability to collect and summarise the requirements. Also understand the market demand/trend in context of software/algorithm development.
Ability to work in a team environment and understanding of the importance of communication in a multi disciplinary/institutional team environment.
Demonstrate the knowledge and skill of project management. Particularly the differentiation and applicability of different types of project management approaches and the relevance to the project in hand.
Demonstrate critical understanding of the software/algorithm design approaches and availability of design tools
Demonstrate critical understanding of the software/algorithm development approaches and availability of development tools/languages.
Critical knowledge about the importance of software/algorithm evaluation/testing and the steps of releasing.
Critical knowledge about the importance of software/algorithm security related issues.
Demonstrate critical knowledge on both object oriented and scripting languages.
Ability to code in distributed cloud as well as stand-alone environement using wide range of programming languages.
Good knowledge on privacy, security issues related to software/hardware/algorithm.
Critical understanding of code sharing, archiving and protection through cloud-based repository platforms.
Good knowledge about different cloud based computing platforms, e.g. AWS
Understanding about opensource/stand-alone/cloud-based software/hardware/algorithm.
Critical knowledge on computing performance and how to address performance related challenges.
KNOWLEDGE MANAGEMENT
Good understanding about big data and their impact on business and society.
Critical knowledge about different steps of data management pipeline – from collection to data analytics
Critical understanding about different data types, sources of data types and their strengths and limitations.
Critical understanding about different data collection processes and resources along with regulations associated to the processes including ethics and permission requirements.
Demonstrate the knowledge on data privacy and it differs in different domains – manufacturing, medical etc.
Critical understanding about data quality, particularly standard process of measuring data quality.
Demonstrate the appreciation towards the importance of data cleaning and knowledge on different steps, tools used for data cleaning.
Understanding about the data validation process and its importance towards data management.
Good knowledge about different data warehousing techniques and technical details for implementing different types of databases.
Updated knowledge about data warehousing for both structured and unstructured data.
Critical knowledge about the approach to query the data as per the requirements of the users.
Good understanding about the process of data transformation in relation to the users requirements.
Provide detailed knowledge and skill on different data security related issues and how to identify different types of threats.
Explain different types of data protection measures that can be taken to safeguard data breach.
Understand institutional policies related to data security and privacy and tools required to implement these policies.
Good understanding about intellectual property rights and governance laws.
KNOWLEDGE ABSTRACTION
Demonstrate good knowledge of algebra/stat and calculus that enables students to refresh their high school math knowledge.
Provide detailed understanding of distribution and probability statistics.
Critical understanding on intelligent agent and different types of logic representations.
Different algorithms (structured, unstructured, adaptive) – their applications and refinement of algorithm parameters.
Critical knowledge on algorithm testing, evaluation and optimisation.
Good understanding of ethics and policy related to algorithm development and deployment.
Up to date knowledge on state of the art algorithms implemented by different stakeholders.
Basic understanding on how to protect intellectual property rights related to algorithms and the process of protecting these rights through third party.
Provide detailed understanding of algorithms used for image analysis and object detection from including timelapse and multimodal images.
KNOWLEDGE REPRESENTATION/COMMUNICATION
Evaluate and apply data visualisation grammar and principle to the whole of the visualisation process and the resulting presentations.
Evaluate the capabilities of different visualisation tools and programming languages, both proprietary and open-source, to support the discovery and display of critical and valuable answers hidden in small, medium and large data.
Implement analysis and visualisation techniques using realistic data sources from disparate disciplines and using the most appropriate visualisation tools in order to identify the valuable questions and to develop well justified, actionable answers.
Good understanding of processes to know the audience in terms of their requirements, domain knowledge etc.
Differentiate between exploratory and explanatory data visualisation and or knowledge representation.
RESEARCH/SOFT SKILLS
Understanding of core aspects of philosophy and its sub discipline.
Explore and express different ideas of philosophy and their relevance to research in higher education.
Introduction to the main ideas of logic and methods of recognising relevant information to construct persuasive arguments.
Develop analytical, argumentative problem-solving skills.
Develop critical thinking and problem-solving skill in a collaborative manner.
Critical understanding of research methods in higher education and steps involved from idea generation through to publication and or application.
Critical understanding of project management and role of different team members at different levels along with the interplay.
Knowledge about different administrative and operational tasks required for successful project management.
Basic understanding of activities related to dissemination of research outcome to wider audience.
Basic knowledge of social media-based profile creation e.g. LinkedIn profile that will facilitate future job prospects.