

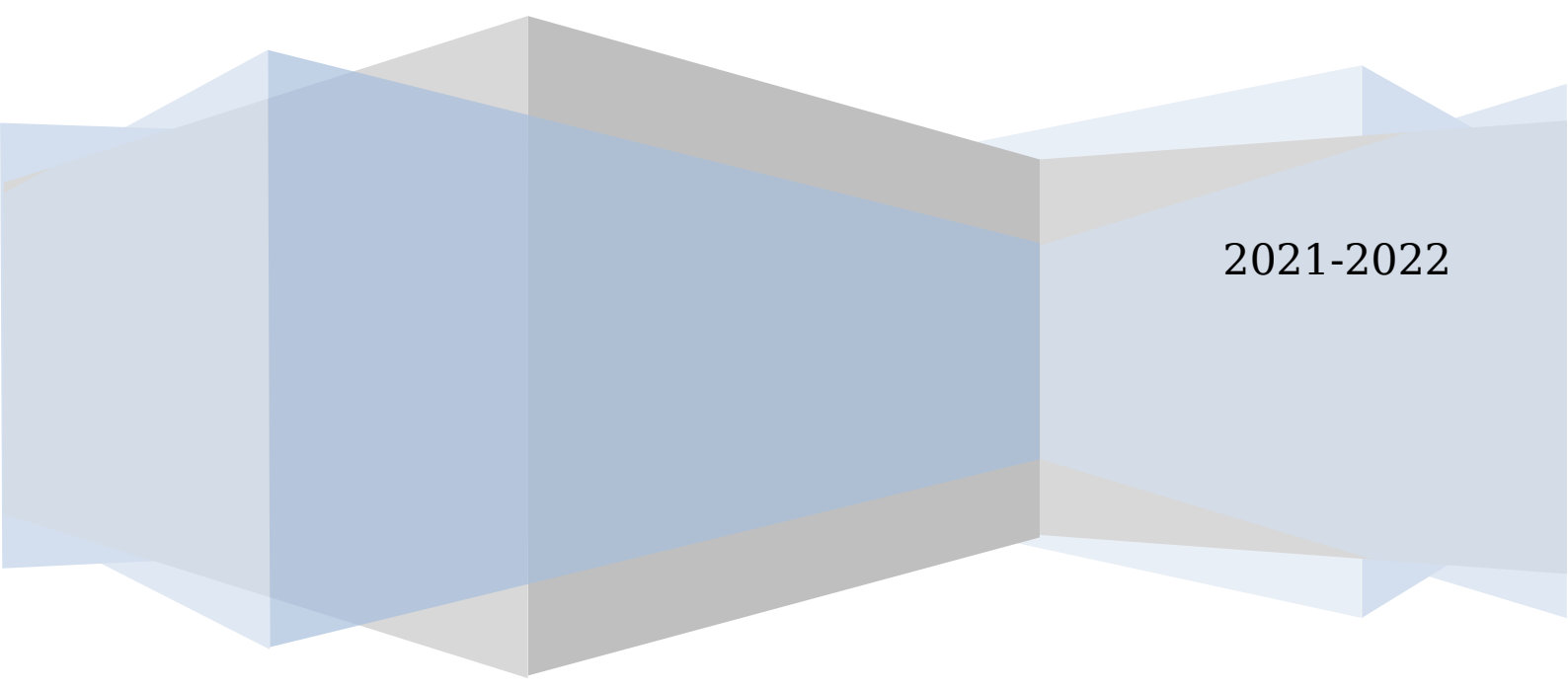
**VARNA UNIVERSITY OF
MANAGEMENT**

Software Metrics - Tools and Methodologies

Module handbook

Yordanka Budinova

2021-2022



Varna University of Management

Module: *Software Metrics - Tools and Methodologies*

Programme: BSc Software Engineering

Module Leader: Yordanka Budinova

Course Description

This subject offers an interactive introduction to software metrics oriented toward computer science and engineering. The subject coverage divides roughly into:

1. Fundamental concepts of SW metrics: Definitions, measure, tools and methodologies.
2. Management Metrics
3. Software Quality Metrics
4. Software Requirements Metrics
5. Software Design Metrics
6. Software Maintenance and Operation.

On completion of the course students will be able to explain and apply the basic tools and methods of software metrics in computer science. They will be able to use these methods in subsequent courses in the design and analysis of algorithms, computability theory, software engineering, and computer systems.

Students will be able to:

1. Use tools to measure the SW metrics
2. Analyse metrics.
3. Apply tools and methodologies to calculate metrics. Write custom code and create reports.
4. Work in small teams to accomplish all the objectives above.

Module assessment:

Grades for the class are based on the following weighting:

Activities	Percentages
Class participation	10%
Assignment 1	25%
Assignment 2	25%
Final exam	40%

Assignments

Two Assignments will be given. The Assignments each count for 25% of the final grade.

Assignment questions will typically be variations of prior problems from class and pssets, and the best way to prepare is to review on the published solutions to these problems. The first exam covers all previous weeks' material; subsequent exams focus on the material after the previous exam. Induction will be covered on Assignment 1.

Final Exam

There will be a four hour final exam. This exam is worth 40% of the final class grade.

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The final exam will cover the entire subject. Most exam questions will be variants of problems assigned during the term (pset, class, midterm, and online). It may include a few questions which combine topics that were originally covered separately.

Module Title	Module Number		
Software Metrics - tools and methodologies	SOFTMET		

Level (3 - 8)	Credits	ECTS Credit	Module Value		
5		5	1.0		

Teaching Period	Pre-requisites
Terms 4	None

Module Leader	School	Campus
Yordanka Budinova	Varna University of Management	Varna

Assessment Methods			
Assessment Type	Duration/Length of Assessment Type	Weighting of Assessment	Approximate Date of Submission
PRAC1 - Practical Work	Assignment 1	25%	Submission Tue, 23 Nov 2021
PRAC2 - Practical Work	Assignment 2	25%	Submission Tue, 14 Dec 2021
Class participation		10%	Ongoing during the semester
Exam	4 hours	40%	Wed 5 Jan 2022

Aim(s)
The aim of this course is to define the software metrics and tools for measurement. There has been much recent interest in measurement and analysis with qualitative and quantitative tools and methods to measure and analyse at the project, process, program and enterprise levels.
Learning Outcomes
The course aims to give the student an understanding of decision-making management supported of Software quality measurements. With the increasing sophistication of software, questions of quality go beyond whether or not the software works to how well it achieves measurable quality goals

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Learning and Teaching Delivery Methods	
Learning	24 hours
Tutorials	24 hours
Student Centred Learning	77 hours
Total hours	125 hours

Indicative Content		
<p>1. Six Sigma and CMMI - As CMMI has become more widely institutionalized and Six Sigma has made its way into engineering disciplines, organizations more often want to know how to leverage Six Sigma within software process improvement initiatives. Six Sigma tools and methods that map Six Sigma to CMMI, Teach the practical application of Six Sigma, descriptions of experiences using the methods, and uses of Six Sigma as a tool for reaching high maturity.</p> <p>2. Goal-driven measurement - helps engineers to identify and define software measures to support your own organization's business goals. Goal-driven measurement using the goal-question-indicator-metric (GQIM) method.</p> <p>3. Project Management - In successful measurement and analysis programs, managers and practitioners are able to use measurement as the foundation for making informed decisions about projects and products.</p> <p>4. Measurement and Analysis Infrastructure Diagnostic (MAID) - Organizations run on data. They use it to manage projects and the enterprise, make decisions, and guide improvement. But how reliable is the data you collect? MAID method as tool for diagnosing and improving your measurement and analysis activities.</p>		
Category		Metrics
1	Management Metrics	<ul style="list-style-type: none"> • Size: Lines of Code (LOC*), Thousand Lines of Code (KLOC) • Size: Function points, Feature Points • Individual Effort: hours • Task Completion Time: hours, days, weeks • Project Effort: person-hours • Project Duration: months • Schedule: earned value • Risk Projection: risk description, risk likelihood, risk impact
2	Software Metrics	<p>Quality</p> <ul style="list-style-type: none"> • Defect Density - Defects/KLOC (e.g., for system test) • Defect Removal Rate - defect removed/hour (for review and test) • Test Coverage • Failure Rate
3	Software Requirements Metrics	<ul style="list-style-type: none"> • Change requests received, open, closed • Change request frequency • Effort required to implement a requirement change • Status of requirements traceability

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			<ul style="list-style-type: none">• User stories in the backlog
4	Software Metrics	Design	<ul style="list-style-type: none">• Cyclomatic Complexity• Weighted Methods per Class• Cohesion - Lack of Cohesion of Methods• Coupling - Coupling Between Object Classes• Inheritance - Depth of Inheritance Tree, Number of Children
5	Software Maintenance and Operation		<ul style="list-style-type: none">• Mean Time Between Changes (MTBC)• Mean Time To Change (MTTC)• System Reliability• System Availability• Total Hours of Downtime

Required and Recommended Reading

Required Reading

Recommended Reading

S.H. Kan, *Metrics and Models in Software Quality Engineering*, 2nd ed., Addison-Wesley, 2002.

ISO/IEC, *25010:2011 Systems and Software Engineering—Systems and Software Quality Requirements and Evaluation (SQuaRE)—Systems and Software Quality Models*, ISO/IEC, 2011.

IEEE Std., *IEEE Std. 1012-2012 Standard for System and Software Verification and Validation*, IEEE, 2012.

IEEE Std., *1028-2008, Software Reviews and Audits*, IEEE, 2008.

ISO/IEC/IEEE, *24765:2010 Systems and Software Engineering—Vocabulary*, ISO/IEC/IEEE, 2010.

T. Gilb, *Principles of Software Engineering Management*, Addison-Wesley Professional, 1988.

T. Gilb and D. Graham, *Software Inspection*, Addison-Wesley Professional, 1993.

Access to Specialist Requirements

None

Assignment 1

Calculate the following metrics and generate reports for:

- LOC
- PLOC
- Comments

for:

- yours code snippet from public repository - *must be attached*
- Java enterprise Hello world example -

<https://gist.github.com/lolzballs/2152bc0f31ee0286b722>

2 reports - *must be attached*

lecturer: Yordanka Budinova

student:

date:

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Appendix 1

SOFTMET SOFTWARE METRICS - TOOLS AND METHODOLOGY: ASSIGNMENT 1: (2021-22) MARKING AND FEEDBACK SHEET								
Student number:								
ASSESSMENT CRITERIA	Max. marks	70+	60	50	40	35	30	Feedback (see also comments in the assignment)
<i>Are the 2 reports and code differencies attached; provided link to the repository</i>	50							
<i>Are the tools fully explained</i>	20							
<i>Is the custom code attached</i>	10							
<i>More than 2 tools and languages, code improvements > 80%</i>	20							
OVERALL FEEDBACK (see also comments in the assignment): 								
1 st marked by:				Signed:		Dated:		GRADE
Second Markers' comments (if relevant): 								
2 nd marked by:				Signed:		Dated:		GRADE
Consolidated mark and comments:								FINAL MARK
External Examiner comments (if relevant): 								

Assignment 2

SW metrics - For an url - https://en.wikipedia.org/wiki/Software_metric copy the web-console performance data. This should be done with **Selenium webdriver** and Java Script. The **json** output should be written in a file. Also it should be parsed as "**name**" "**duration**" *for each url* in a **csv** file.

The program should have a **cycle**. You need to measure the performance 10 times and calculate the **average performance**.

Produce **.json** - Make the JSON Prettified.

Everything MUST BE AUTOMATED with a JENKINS job.

Import the csv file in excel/ libre office for easy reading/sorting.

Send all files in archive format.

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Appendix 2

SOFTMET SOFTWARE METRICS - TOOLS AND METHODOLOGY: ASSIGNMENT 2: (2021-22) MARKING AND FEEDBACK SHEET								
Student number:								
ASSESSMENT CRITERIA	Max. mark s	70 +	69- 60	59- 50	49- 40	39- 35	34- 0	Feedback (see also comments in the assignment)
<i>Is the json file created</i>	50							
<i>Calculate the average in performance</i>	5							
<i>Is the custom code attached</i>	10							
<i>Created JENKINS job screenshots attached; artefacts generated</i>	25							
<i>Import the csv file in spreadsheet - attached</i>	10							
OVERALL FEEDBACK (see also comments in the assignment):								
1 st marked by:				Signed:		Dated:		GRADE
Second Markers' comments (if relevant):								
2 nd marked by:				Signed:		Dated:		GRADE
Consolidated mark and comments:								FINAL MARK
External Examiner comments (if relevant):								