Software Engineering Stage 6 (Year 12) – sample assessment task notification

Software automation

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# About this resource

## Purpose of resource

This sample assessment task notification unpacks how teachers can assess students in the Software automation focus area of Software Engineering Year 12.

## Target audience

This resource can be used to support teachers with effective syllabus implementation.

## When and how to use

The resource can be adapted to suit the context of the school. This sample task could be used for summative assessment if it fits within teachers existing assessment schedule.

\*The [assessment schedule](https://education.nsw.gov.au/teaching-and-learning/curriculum/tas/tas-curriculum-resources-7-12/tas-11-12-curriculum-resources/assessment-schedule-software-engineering-year-12) published by the department did not include this as one of the assessment tasks and instead suggested this content be formally assessed in the trial examination.

Teachers choosing to modify their scope and sequence and assessment schedule to include this task for summative assessment of the focus area are recommended weighting it at 30%. The task requires students to develop a solution, project documentation and presentation.

Other implementation approaches include blending this into a whole year project or delivering as a formatively assessed group project.

# Task description

**Type of task**: develop a solution, project documentation and presentation for the Software automation focus area.

**Outcomes being assessed**:

A student:

* justifies methods used to plan, develop and engineer software solutions **SE-12-01**
* applies structural elements to develop programming code **SE-12-02**
* evaluates practices to safety and securely collect, use and store data **SE-12-04**
* justifies the selection and use of tools and resources to design, develop, manage and evaluate software **SE-12-06**
* tests and evaluates language structures to refine code **SE-12-08**
* applies methods to manage and document the development of a software project   
  **SE-12-09**

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**\*Suggested weighting**: 30%

Students consider various machine learning algorithms and models to create a mark estimation program. They are guide through a simple application of a linear regression algorithm using Python code (by importing NumPy and scikit-learn machine learning frameworks). The use of these modules imported into Python is assumed by their reference in the code sample from page 18 of the [Software Engineering course specifications](https://curriculum.nsw.edu.au/learning-areas/tas/software-engineering-11-12-2022/overview#software-engineering-course-specifications-software_engineering_11_12_2022) (Course specifications).

# Project description

A student named Alex has missed a maths exam.

Her teacher needs to estimate Alex's score and has been told that machine learning can predict a student's mark on a missed assessment by analysing historical data, identifying patterns, and using these patterns to make informed predictions.

Alex’s maths teacher has also been told that you are studying machine learning and may be able to help.

Use Python with the NumPy and scikit-learn modules to calculate Alex’s potential score.

The product will be a program to predict student grades for missed assessments.

You are to:

* set up the work environment
* set up the training data
* plan the UI
* code initial functionality
* plan the estimation algorithm and overall system structure
* code remaining functionality
* test and evaluate.

**Student support material**

* [scikit-learn](https://scikit-learn.org/)
* [Matplotlib](https://matplotlib.org/)
* [NumPy](https://numpy.org/)

## Teaching advice

Estimating the mark can be done through several levels of complexity.

A simple implementation would consider a single dimension, for example, a mark estimated through looking at the students’ marks in other assessments only.

A better solution would consider the estimate by looking at two dimensions and looking at what other students got for that assessment as well.

High solutions may be able to analyse the data and see if a linear or polynomial regression model is best for the specific data. For example, some classes may see marks that progress in a linear fashion however other classes may improve over time with marks instead fitting on a curve.

Other considerations include the use of standard deviations, z scores and the use of averages of other tasks. Teachers should lead a class discussion introducing the problem statement and how to best approach the task to ensure fairness. Students should be motivated by the nature of this process as it applies to their high school experience. The discussion should include the conditions for being able to estimate a mark (decision tree) including:

* Are there enough students present to estimate the mark effectively?
* Are there not too many gaps in the data?
* Are the marks consistent enough to estimate the mark effectively?
* Have enough assessment tasks been completed?

# Submission details

Students are to submit 3 components – Component A, B and C.

## Component A

Documentation of the project including:

* IPO tables
* diagrams
* decision tree
* intrinsic documentation
* supporting information
* evidence of testing
* social and ethical issues.

See the [Course specifications](https://curriculum.nsw.edu.au/learning-areas/tas/software-engineering-11-12-2022/overview#software-engineering-course-specifications-software_engineering_11_12_2022) for guidelines on how to present some project documentation elements.

## Component B

A zip file of any implemented solution or sample code including use of training data, consideration of overall structure, OOP layout and evidence of usability considerations.

## Component C

A presentation to the class who are playing the role of the teacher client with questions and answers including justification of the model.

## Steps to success

Table 1 – assessment preparation schedule

|  |  |
| --- | --- |
| Steps | What I need to do |
| Set up the work environment | 1. Install and test Python3 and a relevant integrated development environment (IDE).  * pip3 install NumPy and scikit-learn * If using a graphic user interface (GUI), students may want to also have TKinter or PyGame installed as well. |
| Set up training data | 1. Obtain or mock up a CSV file with marks for a class. There should be at least 4 tasks in the markbook and a reasonable number of students. |
| Plan the UI | 1. Create a storyboard for the pages that will be present in the system. The user interface (UI) may be graphical or a command-line interface (CLI), or a mixture of both. |
| Code initial functionality | 1. Code the means for importing and displaying the marks held within the CSV markbook file. 2. Code a means for specifying which student and which assessment task the estimated grade should be calculated for. |
| Plan estimation algorithm and overall system structure | 1. Decide whether a linear, polynomial or logistic regression model is most appropriate and provide justification. 2. Create a decision tree outlining the conditions for a missing assessment mark to be reliably calculated. 3. Create an Input, Process, Output (IPO) table with a general strategy. 4. Use a diagram (for example, a class diagram or structure chart) to express the structure of your product or processing. Provide justification for your choice of diagram. |
| Code remaining functionality | 1. Using an agile development approach and object-oriented paradigm (OOP), build out the rest of the functionality. |
| Test and evaluate | 1. Provide a report demonstrating that you have tested your product, recording any syntax, logic and runtime errors you identify. 2. Provide an outline of whether the system is using artificial intelligence (AI) or machine learning (ML). 3. Assess any social and ethical impacts of the system and any dangers of bias in the system. |

## What is the teacher looking for?

This task will require students to create a system to predict marks for students for missed assessment tasks.

The system will incorporate:

* the creation of a relevant UI (either graphical or CLI)
* the ability to read data from a file (stored as CSV).

The mark estimation system is to have the following functionality:

* Allow for current marks to be displayed with missing marks clearly labelled.
* Have an effective means for the user to identify which marks are to be estimated.
* Present the estimated mark with supporting information (for example, task average).
* Allow the markbook to be exported (as CSV) with estimated marks incorporated.

The testing and evaluation report will incorporate:

* evidence of thorough testing
* thoughtful discussion and evaluation of the social and ethical issues.

## Marking guidelines

Table 2 – assessment marking guidelines

|  |  |
| --- | --- |
| Grade | Marking guideline descriptors |
| A | The student:   * develops highly effective and clean code using effective programming methodology * provides comprehensive planning documentation with broad and strong training data * demonstrates an extensive understanding of designing and creating effective and accessible UIs * creates a solution that effectively estimates marks taking into account several factors * provides detailed information supporting their estimate * demonstrates an extensive ability to test and document their system and its impacts. |
| B | The student:   * develops effective and clean code using effective programming methodology * provides effective planning documentation with relevant training data * demonstrates a thorough understanding of designing and creating clean and accessible UIs * creates a solution that provides a reasonable estimated mark using more than one factor * provides more than one piece of information supporting their estimate * demonstrates a thorough ability to test and document their system and its impacts. |
| C | The student:   * develops sound code using some characteristics of effective programming methodology * provides valid planning documentation with relevant training data * demonstrates a sound understanding of designing and creating useable and accessible UIs * creates a solution that provides an estimated mark using a single factor * provides a relevant piece of information supporting their estimate * demonstrates a sound ability to test and document their system and its impacts. |
| D | The student:   * develops basic code using effective programming methodology * provides limited planning documentation with some training data * demonstrates a basic understanding of designing and creating UIs * organises some data within the database and accesses attempts to access it with SQL * demonstrates an attempt to test and document their system. |
| E | The student:   * identifies some requirements for the documentation and production of the system * demonstrates some understanding of designing and creating UIs. |

## Student-facing rubric

Table 3 – rubric for Software automation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Criteria | Outstanding | High | Sound | Basic | Limited |
| Mark | (5 marks) | (4 marks) | (3 marks) | (2 marks) | (1 mark) |
| Project management |  |  |  |  |  |
| Training data |  |  | Useful training data is created that will allow the system to be reasonably tested from a variety of perspectives. | Adequate training data is present that allows for the system to be tested. | An attempt has been made to create relevant training data. |
| IPO tables | IPO tables are presented correctly and outline a sophisticated plan for the processing in a concise manner. | IPO tables are presented correctly and outline a well thought out plan for the processing. | IPO tables are mostly presented correctly and represent the intended logic in a readable manner. | An attempt has been made to produce IPO tables representing some processing relevant to the scenario. | An attempt has been made to produce IPO tables. |
| Class diagram | A relevant diagram has been presented correctly that outlines a thorough and concise structure for the code. | A relevant diagram has been presented correctly that outlines a well thought out and clean structure for the code. | A diagram is presented, mostly correctly, that outlines the intended structure for the code. | An attempt to model the intended structure of the program through a diagram. The diagram contains some errors. | An attempt has been made to use a diagram relevant to the system. |
| Justification of model |  |  | A relevant regression model has been selected and justified well. | A relevant regression model has been selected but the justification could be stronger. | An attempt has been made to link a regression model to the scenario. |
| Decision tree |  | A valid decision tree presented correctly and cleanly with well thought through criteria. | A valid decision tree, presented mostly correctly, with valid criteria. | A decision tree is presented with some criteria relevant to the scenario. | An attempt has been made to create a decision tree. |
| Programming |  |  |  |  |  |
| Overall structure | Code is structured cleanly and neatly making for easy-to-follow code that is maintainable and extensible. Comments are used effectively to help convey the structure. | Code is structured in an easy-to-follow manner with a logical structure. Comments are used appropriately to convey the overall structure. | Code is mostly organised with a general structure that maps to the processing. Comments are present, helping to guide the reader. | There is some general structure to the code. Comments are present outlining the purpose for some sections of code. | An attempt has been made to structure code neatly. |
| OOP layout | A solid breakdown of code into classes making effective use of methods, attributes and OOP concepts. | A logical breakdown of most code into classes making good use of methods, attributes and OOP concepts. | Classes are used for a reasonable amount of the code with relevant use of methods, attributes and OOP concepts. | Classes are used in some areas of the code, but their usage could be improved. | An attempt has been made to use classes in the code. |
| Intrinsic documentation |  |  | Effective use of intrinsic documentation across all code that is present. | Mostly good use of intrinsic documentation adds to the readability and maintainability of the code. | An attempt has been made to use intrinsic documentation techniques. |
| Overall functionality |  |  |  |  |  |
| Evidence of usability considerations |  | Submission demonstrates a sophisticated UI that is clean and unambiguous. | Submission shows good consideration of usability. Interaction and presentation of data is sound. | Submission shows some consideration of usability. Interaction with the system works but there is room for improvement. | An attempt has been made to incorporate usability in the submission |
| Importing data |  | Evidence of data wrangling by importing correctly and identifying and managing invalid data. | Some evidence of data wrangling during import. Some invalid data is identified and indicated in some manner. | Little evidence of data wrangling during import. Data is imported though it may not be reliable. Invalid data is not identified. | An attempt has been made to import data from a file. |
| Estimating mark | A highly effective mechanism is created that estimates marks using several factors. | An effective mechanism is created that estimates marks using more than one factor. | A mechanism that creates a reasonable estimate based upon a single factor. | A mechanism that creates an estimate though the estimate may not be that accurate. | An attempt has been made to estimate a mark. |
| Supporting information |  | Several pieces of useful supporting information are presented in an effective manner. | Some valid data is presented in a useable manner to support the estimate. | Some data relevant to the scenario is present. | An attempt has been made to show a piece of data. |
| Testing and evaluation |  |  |  |  |  |
| Testing | Extensive testing is documented within the process diary and each task specification is addressed. | Thorough testing is documented within the process diary and most task specifications are addressed. | Some testing is documented within the process diary and task specifications are mentioned. | Testing is mentioned within the process diary and task specifications may be included. | An attempt has been made to test the solution against the task's specifications. |
| Social and ethical issues | A thorough analysis of the potential impacts of the product from a variety of perspectives. | A detailed analysis of the potential impacts of the product from several perspectives. | A sound analysis of the potential impacts of the product. | Some analysis of social and ethical issues relating to the product. | An attempt has been made to discuss some issues relevant to the product. |
|  |  |  |  | **Total** | **/60** |

## Support and alignment

**Resource evaluation and support**: all curriculum resources are prepared through a rigorous process. Resources are periodically reviewed as part of our ongoing evaluation plan to ensure currency, relevance and effectiveness. For additional support or advice contact the TAS curriculum team by emailing [TAS@det.nsw.edu.au](mailto:TAS@det.nsw.edu.au).

**Differentiation**: further advice to support Aboriginal and Torres Strait Islander students, students learning English as an additional language or dialect (EAL/D), students with a disability and/or additional needs and high potential and gifted students can be found on the [Planning, programming and assessing 7–12](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12) webpage. This includes the [Inclusion and differentiation 7–10 advice](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12/inclusion-and-differentiation-advice-7-10) webpage.

**Assessment**: further advice to support formative assessment is available on the [Planning, programming and assessing 7–12](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12) webpage. This includes the [Classroom assessment advice 7–10](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12/classroom-assessment-advice-7-10-). For summative assessment tasks, the [Assessment task advice 7–10](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12/assessment-task-advice-7-10) webpage is available.

**Consulted with**: Curriculum and Reform and subject matter experts.

**Alignment to software priorities and/or needs**: [School excellence](https://education.nsw.gov.au/policy-library/policies/pd-2016-0468)

**Alignment to the School Excellence Framework**: this resource supports the [School excellence](https://education.nsw.gov.au/policy-library/policies/pd-2016-0468) elements of curriculum (curriculum provision) and effective classroom practice (lesson planning, explicit teaching).

**Alignment to Australian Professional Standards for Teachers**: this resource supports teachers to address [Proficient Teacher Standard Descriptors](https://www.nsw.gov.au/education-and-training/nesa/teacher-accreditation/proficient-teacher/standard-descriptors) **3.1.2, 3.3.2, 3.4.2, 5.1.2.**

**NSW Syllabus**: Software Engineering 11–12

**Syllabus outcomes**: SE-12-01, SE-12-02, SE-12-04, SE-12-06, SE-12-07, SE-12-08, SE-12-09

**Author**: TAS, Curriculum Secondary Learners, Curriculum Reform

**Publisher**: State of NSW, Department of Education

**Resource**: sample assessment task notification

**Related resources**: further resources to support Software Engineering 11–12 can be found on the [TAS curriculum page](https://education.nsw.gov.au/teaching-and-learning/curriculum/tas).

**Professional learning**: relevant professional learning is available through [HSC Professional Learning](https://education.nsw.gov.au/teaching-and-learning/professional-learning) or on the [TAS curriculum page](https://education.nsw.gov.au/teaching-and-learning/curriculum/tas).

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# References

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