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C964: Computer Science Capstone Template

**Warning:** Though it is not stated in the official resources, evaluators do not like outlines.  Write narratively using paragraphs with complete sentences. Use these [C964 examples](https://ashejim.github.io/C964/resources.html#examples) to see what evaluators typically expect.

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# Part A: Letter of Transmittal

## Letter of Transmittal Requirements

The *Letter of Transmittal* should convince senior leadership to approve your project. Write a brief cover letter (suggested length 1-2 pages) describing the problem, how the application (part C) applies to the problem, the practical benefits to the organization, and a brief implementation plan. Include all artifacts typical of a professional (business) letter, e.g., subject line, date, greeting, signature, etc.

The letter should be concise and target a non-technical audience. Include the following:

* A summary of the problem.
* A proposed solution centering around your application.
* How the proposed solution benefits the organization.
* A summary of the costs, timeline, data, and any ethical concerns (if relevant).
* Your relevant expertise.

## Letter Template

[Today’s date]

[Recipient’s name]

[Company name]

[Address]

Dear [Recipient’s name],

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Sincerely,

[Sign here: e.g., Jane Smith]

[Your name, title]

# Part B: Project Proposal Plan

The project proposal should target your client’s middle management. This audience may be IT professionals but have limited computer science expertise. Use appropriate industry jargon and sufficient technical details to describe the proposed project and its application. Remember, you’re establishing the technical context for your project and how it will be implemented for the client. **Write everything in the future tense.**

## Project Summary

* Describe the problem.
* Summarize the client and their needs as related to the problem.
* Provide descriptions of all deliverables. For example, the finished application and a user guide.
* Provide a summary justifying how the application will benefit the client.

## Data Summary

* Provide the source of the raw data, how the data will be collected, or how it will be simulated.
* Describe how data will be processed and managed throughout the application development life cycle: design, development, maintenance, etc.
* Justify why the data meets the needs of the project. If relevant, describe how data anomalies, e.g., outliers, incomplete data, etc., will be handled.
* Address any ethical or legal concerns regarding the data. If there are no concerns, explain why.

## Implementation

* Describe an industry-standard methodology to be used.
* An outline of the project’s implementation plan. The focus can be the project’s development or the implementation of the machine learning solution.

## Timeline

* Provide a projected timeline. Include each milestone and deliverable, its dependencies, resources, start and end dates, and duration. (a table is not required but encouraged).
* Dates should be in the future. Write ‘NA’ where an item is not applicable.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Milestone or deliverable** | **Project Dependencies** | **Resources** | **Start and End Date** | **Duration** |
|  |  |  |  |  |
|  |  |  |  |  |

## Evaluation Plan

* Describe the verification method(s) to be used at each stage of development.
* Describe the validation method to be used upon completion of the project.

## Costs

Include the itemized costs of the project. Include specific item names where applicable, e.g., ‘PyCharm Professional Ed. 2024.3.5.’

* Itemize hardware and software costs.
* Itemize estimated labor time and costs.
* Itemize estimated environment costs of the application, e.g., deployment, hosting, maintenance, etc.

# Part C: Application

Part C is your submitted application. This part of the document can be left blank or used to include a list of any submitted files or links.

The minimal requirements of the submitted *application* are as follows:

1. **The application functions as described.** Following the ‘User Guide’ in part D, the evaluator must be able to review your application on a Windows 10 machine successfully.
2. **A mathematical algorithm applied to data,** e.g., supervised, unsupervised, or reinforced machine learning method.
3. **A “user interface.”** Following the ‘User Guide’ in part D, the client must be able to use the application to solve the proposed problem (as described in parts A, B, and D). For example, the client can input variables, and the application outputs a prediction.
4. **Three visualizations.** The visualizations can be included separately when including them in the application is not ideal or possible; e.g., the visualizations describe proprietary data, but the application is customer-facing.
5. **Submitted files and links are static and accessible.** All data, source code, and links must be accessible to evaluators on a Windows 10 machine. If parts of the project can be modified after submission, matching source files must be submitted. For example, if the application is a website or hosted notebook, the `.html` or `.ipynb` files must be submitted directly to assessments.

Ideally, submitted applications should be reviewable using either Windows or Mac OS, e.g., Jupyter notebooks, webpages, Python projects, etc. If the source files exceed the 200 MB limit, consider providing screenshots or a Panopto video of the functioning application and contact your course instructor.

# Part D: Post-Implementation Report

Create a post-implementation as outlined below. Provide sufficient detail so that a reader knowledgeable in computer science but unfamiliar with your project can understand what you have accomplished. Using examples and visualizations (including screenshots) beyond the three required is recommended (but not required). **Write everything in the past tense.**

## Solution Summary

* Summarize the problem and solution.
* Describe how the application solves the problem from parts A and B.

## Data Summary

* Provide the source of the raw data, how the data was collected, or how it was simulated.
* Describe how data was processed and managed throughout the application development life cycle: design, development, maintenance, etc.

## Machine Learning

For each machine learning model (at least one is required), provide the following:

* Identify the method and what it does (the “what”). It’s advisable to include an example of the model’s output.
* Describe how the method was developed (the “how”).
* Justify the selection and development of the method (the “why”).

## Validation

For each machine learning algorithm described in the section above, do the following:

* Identify the model’s machine learning category, e.g., supervised, unsupervised, or reinforced. For blended approaches, identify the category most relevant to the model’s application.
* An appropriate validation method for the model’s performance.

For supervised learning and reinforced learning

* + Describe an appropriate metric(s) for testing the model’s performance.
  + Provide results of testing using the described metric.

For unsupervised learning

* + Describe an appropriate method(s) for testing the model’s performance.
  + Provide the results of testing using the above method. The method should provide an example of the model’s output and how the output is relevant or a metric measuring the model’s performance, e.g., the Rand index or Silhouette Coefficient.

## Visualizations

Identify the location of at least three unique visualizations. They can additionally be included here.

## User Guide

Include an enumerated (steps 1, 2, 3, etc.) guide to execute and use your application.

* Include instructions for downloading and installing any necessary software or libraries.
* Give an example of how the client should use the application.

# Reference Page

Include references for cited works, e.g., (Author, year) following an accepted writing style. References are not required; this page can be removed if no references are used. To cite sources used for code, you should include the references as code comments within the source code.