Computational Thesis

Evaluation of the thesis work and the written document (1 is highest, 5/6 is lowest) for all of the criteria listed below. Most students will score a 2 or 3.

Evaluation of the Student’s contribution to the work (Adviser only)

Originality/Creativity:
1 – Outstanding. The student took their project in directions far beyond what was originally envisioned and/or demonstrated exceptional creativity by taking additional approaches and directions based on their reading or experimental results.
2 – Excellent. Provided new directions for their project based on reading or their results that changed or improved the final project beyond what was originally envisioned.
3 – Average. The student carried out their work as directed by their advisor/mentor, and may have provided some additional ideas or directions based on their results but stayed within the general bounds of the original project.
4 – Below Average. The student did only what was asked of them and did not contribute new ideas or directions.
5 – Poor. The student was unable to follow the project plan.

Work Ethic:
1 – Outstanding. The student worked consistently on their project throughout their time in the lab. They spent more than 20 hours per week on average on their research while on campus and/or accomplished much more than I expected.
2 – Excellent. The student worked consistently on their project throughout their time in the lab. They spent 10 -20 hours per week on average while on campus and/or accomplished more than I expected.
3 – Above Average. The student worked on their project consistently throughout their time in the lab and accomplished a bit more than I expected.
4 – Average. The student worked on their project consistently throughout their time in the lab and accomplished what I expected.
5 – Below average. The student worked sporadically, a few hours for a few days/week, or went long stretches without appearing. The student accomplished much less than I expected.
6 – Poor. The student worked rarely or not at all, accomplishing much less than I expected.

Independence:
1 – Outstanding. The student attained a high level of independence and became self-sufficient in performing analyses/computations and developing their next steps in the project with nominal input from advisors/mentors. This score would indicate the student is on par with early graduate students.
2 – Excellent. The student became largely independent in performing analyses/computations and developing next steps but required occasional guidance from their advisor/mentors.
3 – Average. The student continued to require frequent consultation from mentors, but originated many of the analyses/computations.
4 – Below Average. The student continued to require frequent help with the planning and/or execution of most analyses/computations.
5 – Poor. The student never worked without extensive help in the planning and execution of all analyses/computations.

Perseverance:
1 – Outstanding. The student worked through and solved difficult technical problems on their own. They sought advice beyond their advisors/mentors and/or searched the literature for alternative approaches.
2 – Excellent. The student did not get discouraged when computations/analyses were challenging. They solved technical problems with some advice from mentors/advisors or from searching the literature.
3 – Average. The student needed some encouragement to keep going in spite of technical problems. They relied on mentors/advisors to provide solutions to issues.
4 – Below Average. The student was easily frustrated when things did not go well and/or seemed averse to solving technical problems.
5 – Poor. The student folded up at the first problem and/or failed to seek assistance.

**Analysis/Computation Quality:** *Refers only to the experimental work done independently by the student not by mentors. Please evaluate work conducted while student still had access to campus resources.*

1 – Outstanding. This work is beautiful, creative, error-free, and well-controlled where appropriate, comparable to that of an early career graduate student in the lab.
2 – Excellent. This work is clearly superior, computations/analyses are well designed and, where appropriate, well-controlled, and most are conclusive.
3 – Above average. This work is solid, largely correct, but with occasional errors.
4 – Average. This work is average, has occasional errors, and may need additional computations/analysis to be conclusive.
5 – Below average. This work is sloppy and/or incomplete. It may be missing controls where appropriate and/or may not be interpretable.
6 – Poor. This work is essentially without merit, with no believable results.

**Evaluation of the senior thesis writing and presentation (Adviser and Readers)**

**Thesis Abstract**
The Abstract should accurately summarize the contents of the thesis. Abstracts typically do not contain references. The key aspects of an excellent abstract include:
- a) a brief summary of the problem/question under investigation and its relevance
- b) a brief statement regarding the approach
- c) a concise summary of findings
- d) a summary of the interpretations and/or conclusions based on the findings

**Evaluation:**
1 – The Abstract contains all of the key aspects listed above. It is clear and concise, without extraneous information, and without scientific inaccuracies.
2 – The Abstract contains all of the key aspects listed above and is scientifically accurate. However, it is either not clear and concise or is qualitatively not an outstanding abstract.
3 – The Abstract contains all of the key aspects listed above but contains scientific inaccuracies. Abstracts with inaccuracies or errors should not score above a 3. Abstracts missing a key component should also not score above a 3.
4 – The Abstract is missing more than one of the key components listed above or contains many inaccuracies.
5 – This does not resemble a scientific abstract in that it is missing many of the key components listed above or contains numerous inaccuracies.

**Introduction**
The Introduction to the thesis should establish the context of the work being proposed. The key elements to an excellent introduction are
- a) sufficient background information for a scientist not familiar with your specific field to understand and evaluate the work you did. Concisely summarize pertinent literature to orient the reader.
- b) presentation of the nature and scope of the problem you have investigated. Why is the field important and what has already been done?
- c) clear articulation of the study rationale – why did you do what you did? What was the gap in knowledge or challenge that motivated your study?
- d) a brief summary of your approach and what you discovered, indicating why it is novel and or significant. What did you contribute towards filling that knowledge gap?
**Evaluation:**
1 – The Introduction includes all of the elements listed above and is scientifically accurate. It does not contain extraneous information or material better suited for the Results or Discussion.

2 – The Introduction includes all of the elements listed above, but has one or more of the following deficits: a) has one or two scientific inaccuracies; b) contains extraneous information; c) contains information better suited to the Results or Discussion.

3 – The Introduction is missing one of the elements listed above and has one or more of the following deficits: a) has multiple scientific inaccuracies; b) contains extraneous information; c) contains information better suited to the Results or Discussion.

4 – The Introduction is missing more than one of the elements listed above and has one or more of the following deficits: a) has multiple scientific inaccuracies; b) contains extraneous information; c) contains information better suited to the Results or Discussion.

5 – The Introduction has numerous deficiencies and reads like a rushed draft.

**Thesis Technical Description (within the body of the thesis):** *Students may choose to describe analyses in progress or planned but not completed due to the termination of the on-campus semester. (Alternatively they may defer to the Discussion.)*

1 – All analyses/computations performed or in progress/planned are clearly described and their rationales explained. Understandable by a typical molecular biologist. The description convey more than sufficient information to reconstruct the design and execution.

2 – An excellent summary of the analytical/computational procedures performed or in progress/planned, including rationales. A knowledgeable reader could reconstruct the design and execution with little difficulty.

3 – A very good description of the analyses/computations performed or in progress/planned. The rationale may not always clear. There may be some instances where the author assumed knowledge on the part of the reader, or used lab jargon.

4 – A good summary of the analyses/computations performed or in progress/planned. Occasionally, relevant details are either inappropriate or missing. The analytical/computational design or execution may require some effort to follow. The author used a lot of lab jargon without explanation.

5 – A poor description of the analyses/computations. It would be impossible for a knowledgeable reader to reconstruct the work.

**Approach:**
1 – Chosen approaches are incisive, rigorous and powerful. They allowed the student to rigorously test hypotheses and distinguish between all reasonable models. Both positive and negative results are interpretable.

2 – Approaches as designed provide strong support for (or falsify) hypotheses. Most outcomes are interpretable.

3 – Approaches provide clear support for hypotheses, but do not distinguish between all possible models. Several possible outcomes are not interpretable.

4 – Approaches have little power to distinguish among multiple possible models. They provide some support for hypotheses, but multiple models are consistent with outcomes.

5 – Approaches do not test hypotheses. Analyses/computations have insufficient power to distinguish different models.

**Thesis Results:**
1 – All of the following should be true for this score: Results are presented in a logical, effective and creative manner. Data are presented accurately and clearly and could be easily understood by a typical molecular biologist. Where appropriate, controls and their significance are clearly and thoroughly described. Conclusions are valid, insightful and not over-interpreted. Figures are publication quality, appropriately labeled, with comprehensive legends.

2 – All of the following should be true for this score: The analytical/computational results are described accurately and completely. Conclusions about data and controls are appropriate and not over-interpreted. Figures are high quality, appropriately labeled, with comprehensive legends.
3 – Analytical/computational results are presented in an effective manner. Figures are good quality, appropriate labeled, with comprehensive legends. One or more of the following may be true: conclusions about the data may lack insight. Jargon was utilized often. One or more figures are lacking in quality and/or labeling; legends are adequate.

4 – The data are unorganized or not well presented. One or more of the following may be true: conclusions about the data and controls lack accuracy or insight. A typical molecular biologist might have minor difficulty following the conclusions. Some figures may be lacking in quality and/or labeling or have less than adequate legends.

5 – Analytical/computational results are presented in a confusing or incomplete fashion. One or more of the following may be true: Some portions are unclear or missing. Data are presented in a confusing or incomplete fashion. The student may have misunderstood some of the results, or failed to include or communicate them in an effective manner. Some conclusions may not fit the data or are absent (under-interpreted). Some figures are missing or low quality, poorly labeled, with minimal legends.

6 – Little attention is given beyond a quick statement of the results. The results are missing context and controls, where appropriate, are not described. The student did not understand data or failed to draw conclusions. Figures are missing and/or of poor quality, lacking labels, and legends are minimal.

**Discussion**

A strong discussion will include a concise summary of your major results put into appropriate context with your research question. It is not a repetition of the Results, but should explain why your findings are important and how they help to fill the knowledge gap you provided in your introduction. Any limitations of the study should be analyzed. Future directions or new questions that stem from the work may be discussed.

**Discussion (Analysis): Students may choose to include a discussion of possible outcomes and interpretations of experiments described in the Results that were in progress or planned but not completed due to the termination of the on-campus semester.**

1 – The student provided an in-depth analysis of the results and demonstrated exceptional insight into the broader implications.

2 – The student provided an excellent critical analysis of the data, including ideas that went significantly beyond the simplest interpretation.

3 – The student provided a very good discussion of the results but stayed mostly within the bounds of current thinking and/or primarily reiterated results with some analysis.

4 – The student provided a limited analysis of the data; however, the student mostly reiterated the results without further expansion.

5 – The student failed to provide a critique and simply reiterated the results.

**Discussion (Future Research): Students may choose to discuss here, rather than in the Results, analytical/computational work in progress or planned but not completed due to the termination of the on-campus semester.**

1 – If planned analytical/computational work is included, it is clearly described and their rationales explained in language understandable to a typical molecular biologist. Anticipated results and their impact are clearly stated and thoughtful.

2 – The thesis contained several good ideas for future work. The ideas build upon the student’s findings, incorporate additional scholarship and are worthwhile suggestions for future research. If planned analytical/computational work is included, it are clearly summarized including rationales. Anticipated results are discussed and their impact clearly stated.

3 – The thesis provided one or two good ideas for future work. These should be relevant to the field but may not move the field forward significantly. If planned work is included, there may be some instances where the author assumed knowledge on the part of the reader, or used lab jargon. A knowledgeable reader could understand the rationale for the work, although the rationale may not always be clearly stated.

4 – The student made a very limited attempt to suggest future studies or directions. Any planned work is mostly clear but the author used lab jargon without explanation or it was overall difficult to assess the value they
would bring to the research.
5 – The student made an unsuccessful attempt or failed to suggest future directions or planned work.

Thesis Scholarship – This thesis:
1 – Is a model of impeccable scholarship. The background material has been thoroughly researched and properly referenced. It is an authoritative assessment of the relevant primary literature. The student has mastered the issues and integrated them to make an original and complete intellectual contribution independent of material mentors provided. The student has provided the reader with the relevant information to understand the significance of the problem at hand.
2 – Shows careful scholarship and frequently cited the primary literature. The student has mastered the relevant material and has integrated it well to set up the thesis research.
3 – Shows average scholarship. The student accurately presented findings from the literature, but relied heavily on reviews rather than primary sources and/or relied only upon materials provided to them by the mentor.
4 – Shows below average scholarship. The student has mastered only a part of the relevant literature. Significant parts of the thesis are not supported by cited material. Important material has been neglected. Insufficient information is provided to understand the thesis research question.
5 – Shows poor scholarship. The student knows or understands little of the relevant literature or has made major errors in interpretation and/or citation.

Thesis Writing – This thesis:
1 – Is outstanding. It is a pleasure to read. It is clear and concise and represents excellence in student writing. It needs no additional editing.
2 – Is exceptionally well written. It is clear and careful and represents excellence in student writing. It however falls short of being outstanding in one or more respects (e.g., unnecessarily verbose).
3 – Is well written, but may require revisions and editing to be fully understandable. Usually clear, but some sections need to be re-read to capture the meaning.
4 – Is poorly written. Significant portions are sloppy or unclear. There are many grammatical errors and ambiguities.
5 – Is difficult to read. Most sections are unclear, ungrammatical and convoluted. Unquestionably a rushed draft that has not been proof-read.