CAPSTONE GUIDE
~ Master of Science Programs ~

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MS Capstone Guidelines
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~ A General Guide for the MS Capstone Experience ~

> The term "capstone" refers to a final culminating educational expectation for MS degree candidates. The capstone experience for a given MS program is defined by the faculty to match the educational goals of that program. It can be implemented as an open-ended experience, i.e. a project or thesis, or as a closed-ended development expectation, i.e. one or more courses with specific creative and professional goals.

Introduction[1]

The capstone experience is the final requirement of the Master of Science degrees offered by your department. The topic chosen for a capstone experience should build upon the student's studies to demonstrate mastery and advanced technical ability. Although we expect students to demonstrate their capabilities as computing professionals and to push their investigations beyond their coursework, this is not a time to change direction and attempt to learn something entirely new. Rather, the purpose of this requirement is to allow the student to pull together the knowledge that has been gained during graduate study and to demonstrate, under the guidance of a faculty committee, creativity and professionalism. At the completion of the capstone work, the student writes a scholarly document and defends the work in a public forum to the satisfaction of the faculty committee members. The faculty prefers that students plan for and complete this requirement immediately after finishing their coursework. Some MS programs, but not all, allow capstone work to be completed at a distance.

Project or Thesis, What's the Difference?

A project involves some type of practical development with a deliverable. This may include development with computer equipment, software packages, and programming or scripting languages. Alternately, it may be the development and demonstration of an innovative process that addresses a current computing issue or problem. As technologies change, capstone resources should keep pace. A well-written professional report is required that details current thinking on the topic in the professional literature, the design and implementation of development that was done, and a critical evaluation of the results.

A thesis involves researching a topic of interest. This research is typically based upon a hypothesis or assertion statement. There may or may not be a development component. It must, however, add some "nugget of knowledge" to the body of literature on the chosen topic. This "nugget" concept refers to originality in thought, application of concepts, implementation, or conclusions on the part of the student. A thesis usually involves the collection of data, analysis, synthesis, or other comparative study. This may be accomplished through quantitative research (producing statistics, through sampling, measurement, etc.), qualitative research (conducted by observation, document studies, interviewing, action research, etc.), or survey. In other words, a thesis is more than simply a large literature review or report on a given topic area. It requires investigation, analysis

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[1] Please note that under RIT's conversion to a 15-week semester calendar, effective fall 2013, the capstone options for a given MS program may change. However, the overall process, expectations and goals for capstone study will be unchanged.

and creativity. In addition, the investigation process and the results are documented in a published document, available to the public through the RIT Library and the Internet.

Capstone Requirements, by program

MS in Human-Computer Interaction (MS/HCI)

Human-Computer Interaction capstone is open-ended: students may elect to do either a MS project or a MS thesis for this experience. Thesis students complete a six-credit (6) graduate capstone investigation as the culminating experience for this MS degree. Project students complete a three-credit (3) experience. The capstone is an empirical study of a HCI problem or the development of a software product through user-centered design processes. Students receive guidance from their committee faculty in developing an experimental design, where appropriate. This capstone is a significant scholarly effort. Students will either participate in research that is suitable for publication in a peer-reviewed journal or will develop a project that will be disseminated in an appropriate public venue.

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HCIN-796       MS HCI Thesis
Capstone experience for the Master of Science in Human-Computer
Interaction. The student will normally pursue this over two semesters
and enroll for 3 credits each semester. During the first semester the
student, working with a committee, will formulate the course of study
and produce a thesis proposal. The proposal will be carried out
during the second semester. The student must submit an accepted
proposal in order to enroll for the second semester.
Prerequisite:  Permission of the HCI Program Coordinator
Credits:       3 per semester x 2 semesters

HCIN-795       MS HCI Project
Capstone experience for the Master of Science in Human-Computer
Interaction. This will typically be a shorter term and more applied
project than the thesis, developed in concert with a committee.
Student must submit an accepted proposal in order to enroll.
Prerequisite:  Permission of the HCI Program Coordinator
Credits:       3
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MS in Information Sciences Technologies (MS/IST)

In the **Information Sciences and Technologies** program, students may elect to do either a MS project, a MS thesis or a capstone course as the capstone experience. The MS/IST capstone can be worth from four (3) up to a maximum of eight (6) credits. If an six-credit thesis is elected, then the number of three-credit elective courses required is reduced by one course. Many students elect to do a three-credit MS project.

Students may also elect a three-credit (3) capstone course. This is a structured course in which the students in the course engage in a team effort to attack a large problem. Each student's role is carefully delineated, and each student's contribution is an individual effort within the team effort.

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ISTE-790       MS Thesis
This is a capstone experience for the Master of Science in
Information Technology program. Students must develop a proposal,
carry it out, and defend their work. Student must submit an
accepted thesis proposal in order to enroll.
Prerequisite:  Completion of all or nearly all MS coursework
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Credits:        6


ISTE-791        MS Project
The capstone experience for the Master of Science in Information
Technology. Students must develop a proposal, carry it out, and
defend their work. Student must submit an accepted proposal in
order to enroll.
Prerequisite:  Completion of all or nearly all MS coursework
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Credits: 3

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ISTE-795        MS Capstone
A course-based capstone experience for the Master of Science in
Information Technology. Students must develop a proposal, carry it
out, and defend their work.
Prerequisite:  Completion of all or nearly all MS coursework
Credits:        3
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MS in Medical Informatics (MS/MI)

The capstone for students in the **Medical Informatics** program is a 3 credit, practical, course-based experience that is completed in the second year of full-time study or at the end of part-time study. Students form development teams to analyze user needs, document clinical processes, and to formally develop information system requirements. Then the teams use new and existing technologies to implement a computer-based medical solution. This capstone includes both individual and team-based milestone expectations, along with a public capstone defense. Both the team and individual components of the project will be evaluated by the program faculty. Since this is a closed-ended capstone, the student receives a grade in the course. This requirement must be completed on-campus.

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MEDI-788        Capstone in Medical Informatics
This team-based course is the first course in a two-course Medical
Informatics Capstone sequence. The course provides students with the
opportunity to apply the knowledge and skills learned in coursework to
designing a solution to a real problem in the medical informatics
domain. Project work initiated in this course will be completed in
Medical Informatics Capstone II (development). Prerequisites:
Completion of all year 1 program requirements.  Offered fall term
only.
   Credits:        3
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MS in Networking and System Administration (MS/NSA)

Students in the **Networking and System Administration** program may complete either a MS project or thesis. The topic chosen should demonstrate your ability as a professional and as a creative and independent thinker. It is also intended as an opportunity for you to demonstrate your mental inquisitiveness and your ability to pursue creative solution strategies or in-depth academic inquiry. In short, it demonstrates your abilities as a information technology professional and scholar.

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NSSA-790        MS Thesis
This is the capstone experience for graduate students in the Master
of Science in Networking and System Administration and the Master of
Science in Computing Security and Information Assurance. This course
will provide an opportunity for students to carry out an individual
piece of research on a specified topic area in the NSSA domain.  This
research should make an original contribution to the body of
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knowledge in the area of study. Students must submit an accepted
thesis proposal in order to enroll.
Prerequisite:  4055-896 or permission of instructor.
Credits:       6


NSSA-791       MS Project
This is a capstone experience for the Master of Science in Networking
and System Administration. This course will enable a student to
perform a critical review, and execute an individual project in a
specific topic area in the NSSA domain. It can include, but is not
limited to, analysis, simulation or implementation of an idea or an
application.  Students must submit an accepted proposal in order to
enroll.
Prerequisite:  4055-896 or permission of instructor.
Credits:       3
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General Considerations

The capstone experiences for our MS programs are student-directed work with the specific purpose of providing the student with an opportunity to apply the education that s/he has received to an independent creative endeavor. The major difference between a project in a course and a capstone experience is that you must individually move beyond your coursework to investigate a topic, manage the design and planning for this effort, and successfully complete the work with appropriate scholarly depth and professional expertise.

You should plan to spend at least six (6) months completing your capstone. Expect to begin the actual capstone work after – not while – you complete your MS coursework. This is not to imply that you shouldn't be thinking about your capstone while you complete your graduate coursework. Rather that, while you may be gathering resources and planning during your studies, the amount of dedicated time and effort necessary to complete the capstone will not typically be available. There are a number of steps in the completion of a capstone. The steps are listed below. There are also a number of forms required as part of this process. They are listed in Appendix D of this document.

You should plan on starting your capstone work within one semester of the time that you complete your last course towards the MS degree and on completing it within one (1) year at most. Your capstone work should be interesting and exciting; and the faculty looks forward to working with you as you complete it. However, please be aware that the faculty cannot be expected to respond to any deadline pressures that you may have due to relocating, termination of financial support, employment requirements, promotion opportunities, I-20 or H1-B deadlines, etc. RIT expects a quality effort.

If you disappear for several years after completing your coursework, it will be much more difficult to satisfy your capstone requirement. As your life and career move you in different directions, technology continues to advance and the skills that you developed in your studies may deteriorate. New students join us each year. Plus faculty members have very busy professional schedules. If you wait to start your capstone, you will find it much more difficult to generate an acceptable topic and to recruit faculty or to return to campus. In addition, you risk losing your previously completed coursework. (Under RIT policy,

you have up to seven (7) years from the time that you took your first course towards the MS degree requirements – excluding any prerequisite coursework; see the "Time Limits" section of this document for details.)

For your capstone, it may be possible to work on an appropriate, industry-sponsored topic. However, this can present problems. Issues such as proprietary concerns or conflicts between satisfying academic constraints versus organizational goals can arise. Students should discuss possible industry projects with the graduate coordinator. If such a project is acceptable, your capstone committee may include an industry representative – either formally or informally. All capstone work is an <u>individual</u> effort, however. In addition, all capstone defenses and the final capstone documentation are public knowledge. Therefore, a letter from your employer confirming that the company approves the project as your capstone, that you will be the only employee working on the project, and that all information included in the final capstone document and defense is non-proprietary is required.

Outline of an Open-Ended Capstone Process

Creating an Initial Idea Document

1. The first step is to identify some ideas that could become the "seed" of your capstone experience. Review your past classes and your past coursework. What have you learned and what would you like to learn more about? Think carefully about the possible topics you've identified. Can you find faculty in the department who share your interest in this topic? Jot down some of their names … you will use them later.

TIP: Many students find it helpful to jot down interesting topics and ideas as they go through their coursework.

2. Select your best idea. Write down as much detailed information about it as you can so that you can transform your rough thoughts into a short document that suitably conveys the general direction and purpose of your idea.

For a project, you will want to phrase your initial discussion in terms of the investigation of a practical problem and its significance. Then *describe* your investigational process and development goals. Be sure to include a clear description of the proposed solution.

For a thesis, you can write a succinct objective/assertion statement or state your research goal as a formal "if hypothesis, then scenario" statement. Then describe your proposed plan of research. Your research should be designed to either prove – i.e. substantiate – your assertion (H0, the null hypothesis) or to disprove it (H1, the alternate hypothesis). The formal hypotheses for a thesis typically have the following general format:[2]

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H0: Application of treatment x will result in no change.
H1: Application of treatment x will result in a change.
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"Treatment *x*" is what you intend to do for your investigation (e.g. modify the design of some key component of a system; use a different implementation strategy; etc). The "change" is the anticipated impact of your investigation (e.g. no improvement in system performance across a specified set of one or more key dimensions or improvement in … aspect of system performance for measures …; etc). Clearly describe the exact change that you anticipate will occur.

3. The initial document may be any length but, generally, a shorter, well-written description is better than a lengthy, rambling document. In most cases, 2 or 3 pages should be sufficient to convey your general idea. Take the time to correct grammatical mistakes, spelling errors, and any other ambiguous aspects of this document. Finally, proof read it one more time to make sure that it as well written as you can make it; if necessary, have it critiqued by the RIT Writing Center (SAU/Monroe Hall-1180).

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[2] This is a very general thesis assertion-pair format. Your capstone faculty may suggest a different statement style.

TIP: Remember that the capstone experience is a culmination of your previous studies. It is not a time to pursue something entirely new. Do not be tempted to pursue an idea that is beyond the current scope of your technical skills and coursework. For example, if your concentrations were in programming and instructional design and you have little web/multimedia experience, this would not be the time to propose a project primarily based upon creating a website or a multimedia CD-ROM. You should not need to take additional courses to support your capstone. Plus, you will not know the faculty outside your concentration areas and as a result, these faculty members will be less likely to be interested in serving on your committee.

TIP: Include a brief discussion of why this topic interests you and the skills/knowledge that you have that lead you to proposing the idea.

TIP: When you're trying to get started, it may help you to look at a few capstone documents completed by other students. Your department maintains a library of past capstone work. You can stop in to the Student Services office (70-2120) or contact the graduate advisor to review some of the capstone documents that we maintain. Copies of theses are also kept by the RIT library and in a public research database.

<u>*Identifying Committee Faculty*</u>

It is important that you correctly identify faculty who may be interested in serving on your graduate committee. Do not blindly send your document to all faculty members. Doing so will waste both your time and that of the faculty.

TIP: Think of such mass, untargeted emails like spam or calls from a telephone solicitor during dinner. The irritating approach taken often negates the value of the content!

4. Before you approach any faculty member, you should do some research on the topic areas of interest them. You will probably want to look at faculty web pages first. The department websites contains information on faculty interests, as well. You will also want to do a literature search in any of a number of online databases available via RIT's Wallace Library (http://library.rit.edu) to see if you can find articles written by individual faculty members. The purpose of this preparation is to help you target faculty members who might be interested in your proposal, and to give you some information about *why* they might be interested. If you feel connected to a specific faculty member, feel free to ask his or her advice on other faculty who may be interested in your idea.

TIP: in addition to having their interests listed in their websites, some faculty also post guidelines and personal proposal requirements for students seeking to do capstones with them. If you want to work with that faculty member, be sure to follow his or her requirements carefully. You don't want to waste either your own or their time!

TIP: it is possible to have faculty from outside of your department on your committee. However, please be aware that faculty time is limited and they must, naturally, give first preference to their own students.

5. You may want to consider making an appointment (office or phone) with your target faculty during their office hours to discuss your ideas. Or you could send your idea to professors who you feel may have some interest in the topic and then follow up with a phone call. As a preface to either method, you will want to elaborate on the information gained in researching individual faculty members. In other words, you should be able to tell the target faculty member *why* you think they might be interested (for example, your idea is an extension of work they've done in the past, your idea builds on the courses that they typically teach, etc.) Additionally, you should be able to explain why you are interested in the topic and detail your coursework and other experiences that have prepared you for your capstone.

6. As you talk with a faculty member, actively solicit ideas and comments about what would make your idea document more attractive or more interesting as a proposal. You can then use this information in the next step to create a strong proposal.

TIP: If you are unable to identify any faculty interested in the idea that you've developed, you must seriously reconsider your idea. Pursuing an idea that does not match with faculty interests can only result in delays in forming your committee.

<u>Creating a Proposal</u>

7. The expansion of your initial document into a full proposal means creating a document that contains a clear statement of the problem for a project or of the assertion (hypotheses) for a thesis, your reason for choosing this topic, the skills that you have that will support your work, a plan or methodology that you will use to solve the problem (indicating the hardware and software technology that you plan to use or the research you will need to conduct), a list of deliverables that includes how you will know when you are done, and a timeline. This proposal should incorporate the comments or suggestions from your initially targeted faculty members. See Appendix A for a sample outline.

8. Again, this proposal document should reflect your <u>best</u> writing. At this point, there should be no spelling or grammatical errors.

If you need writing support, contact RIT's Writing Center in the SAU/Monroe Hall, room 1180. A reference is included in Appendix A of this document.

TIP: Your proposal should form the basis of your final capstone document: introduction, significance, methodology, etc. So taking the time to do complete research and create a well-written document is to your advantage and can save time later.

TIP: If you need to maintain your academic status (I-20, loan repayment, etc.), you may request to be registered for one (1) credit of either MS project or MS thesis proposal while you are working on your proposal. Registering for credit enables you to maintain your academic status and use RIT resources and facilities. However, you must be actively working on your capstone proposal.

9. Use this proposal to clarify exactly what you will be doing in the capstone experience. If at this point you still do not have a full committee (see next step) you can use this proposal to continue to recruit faculty.

Finalizing Your Committee

10. If you are completing a project, you need to form a faculty capstone committee of at least two (2) members. If you are completing a thesis, your committee must include three (3) members. The committee chair must be a member of your department's faculty. In rare situations, other RIT faculty members have been committee chair.

TIP: Your faculty advisor and graduate coordinator are not automatically members of your committee. Remember that the faculty members who will agree to be on your committee are those who have an interest or experience in the topic that you have chosen.

You can petition to have an outside person on your capstone committee. Your outside member must have at least a master's degree and can be from another department at RIT, another university, or from your workplace. You will need the prior approval of both your committee chair and the graduate coordinator. To obtain initial approval, send a request to your committee chair and if approved, forward his or her approval to your graduate coordinator for final approval. If this person is outside of RIT, attach his or her current resume. You will need to explain why you want an outside member and how he or she is relevant to your capstone. There can only be one outside member on your committee.

Finalizing Your Proposal

11. When all of the members of your committee have indicated their approval by signing off on the proposal, submit both printed and electronic copies of it to the graduate coordinator and request approval to register for your capstone credits.

12. When the graduate coordinator approves your proposal, a member of the Student Services staff will contact you. At this point, your proposal becomes an informal contract indicating the specific work to be done and the approval of the topic and tasks by the faculty.

If your proposal is not approved after extensive effort, you and your faculty should meet with the graduate coordinator to resolve the issues that are preventing approval.

TIP: Your approved proposal must precisely define the scope of your work: what you will do, what results will be accomplished, how you know when you are done, etc. This prevents you from becoming stuck in a situation where your capstone requirements shift after you have begun working and you are unable to complete it in a timely manner.

Registration

13. Get registered for your capstone credits. (The Student Services office does this for you!)

When your capstone proposal has been approved by the graduate coordinator, the office staff will contact you about registering for your capstone credits. (We typically only register students for capstone credits when they are ready to actively work on and complete it.)

We can register you for all of your MS project or MS thesis credits at one time if absolutely necessary. However, you should consider the length of time that it will take you to complete your work. Since capstone work can take multiple semesters to complete, it is typically best to spread the credits over multiple semesters to maintain your active status and access to RIT resources.

TIP: Talk with your graduate coordinator or graduate advisor if you are not sure about the best registration plan to fit your situation.

For an MS project capstone[3]: If your work is not completed by the end of the semester in which you register for the credits, you will automatically receive an incomplete, 'I', grade. You have the standard two (2) semesters to complete the work and replace the incomplete grade with the actual capstone grade. After two semesters, the incomplete automatically becomes a grade of 'F'. If you find that you will be unable to complete your project within the two semesters, talk with your committee chair about an extension of the incomplete.

TIP: After multiple years have elapsed, it may be difficult to gain approval from the RIT Registrar for changing a grade of 'F' back to an incomplete. The grade can typically be changed when all capstone work has been completed. However, if an extensive period of time has elapsed, the student may have to re-register (and re-pay) for these credits. So we encourage you to complete your capstone in a timely manner.

For an MS thesis, you will receive a grade of 'R' at the end of the semester, which indicates that you worked on the thesis.

TIP: You may need a full-time equivalency for semesters in which you are registered for capstone credits to maintain your I-20 status or to work on campus, etc. RIT allows a maximum of four (4) full-time equivalencies for capstone work.

TIP: Once you have paid for all of your capstone credits, you may only be registered for zero (0) capstone credits one (1) time (other than in summer terms) to maintain your active academic status. After that you will need to register for capstone continuation credit as discussed in the next tip.
TIP: The zero-credit or continuation-credit capstone registration options are not a way to postpone your capstone work (and any loan repayment) while you look for employment or engage in other unrelated activities.

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[3] A thesis capstone is pass/fail. The way that the faculty indicates when a thesis has been successfully completed is discussed later in this document.

TIP: If you have used up all your opportunities for zero-credit registration or if you have been away from the RIT environment and are re-establishing contact to complete capstone work, you can be registered for the appropriate course below to maintain your matriculated student status:

- *Continuation of MS Thesis (in your program)*
- *Continuation of MS Project (in your program)*

There is a one-credit (1) charge for registering for capstone continuation.

<u>Completing the Capstone Experience</u>

14. Consider consulting the GCCIS subject librarian to help organize your research.

Please consider making an appointment to consult with the GCCIS librarian prior to undertaking research for your capstone project or thesis. A one-on-one consultation with your subject librarian is a great way to learn the best information sources available through the RIT Library and beyond. Consultations are in-depth (plan on scheduling at least one hour) and focused on your individual interests and needs. During a consultation, the subject librarian will demonstrate the use of RIT Library's many online research databases, discuss and plan search strategies, help you analyze your topic of interest, and recommend the best databases and sources so that you can maximize the effectiveness of your literature searches. A capstone consultation is also an opportunity to familiarize yourself with useful services provided by the RIT Library, such as interlibrary loan (acquiring documents from other academic libraries), citation management software[4], thesis binding, and electronic archiving of your capstone work through the RIT Digital Media Library. (See the later section on "Binding" for the requirements for binding a project capstone.)

To make a capstone consultation appointment, contact the RIT Library Liaison for GCCIS: Roman Koshykar, at 475-2238 or rgkwml@rit.edu .

15. Do the work.

TIP: A MS capstone generally takes two (2) semesters of full-time effort to complete. Typically this means one semester to organize your effort (proposal, research, etc), and another semester to complete the work. The longer you linger, the more likely it is that the technology and the faculty will have changed from when you completed your coursework. Procrastination will only result in lengthy delays and more effort in completing the capstone experience.

TIP: Get support from the RIT (Wallace) Library. The library offers significant support for graduate research and capstones done at RIT. This includes:

- *A compilation of available resources at http://library.rit.edu/pubs/guides/thesis.htm.*
- *Resources to help you develop, maintain and organize your research/bibliography references:*

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[4] Check out the Wallace Library's "Research Assistance" section at http://library.rit.edu.

- *Appropriate citing: http://library.rit.edu/researchguides/citing.html*
- *Noodlebib: http://library.rit.edu/electronic/noodletools/noodletools.html*
- *EndNote: http://library.rit.edu/electronic/endnote/endnote.html*
- *Scholarly Publishing Studio (Bldg. 5; 1st floor): Graduate students use the Scholarly Publishing Studio for publishing support and copy editing/ writing assistance. http://wallacecenter.rit.edu/publishing*

16. As you work, keep in touch with your committee members. You should minimally be in contact with them one to two times per month. So, plan to submit frequent drafts of your document and to do periodic demonstrations.

Occasionally, problems can occur during the completion of capstone work: research may not progress as anticipated, development problems can arise, anticipated resources may not become available, etc. If the problem(s) are significant, it may become necessary to revise your capstone proposal. This is the time to talk with your faculty. Any and all change(s) must be approved by your capstone faculty in advance.

TIP: Changing the scope or direction of your project/thesis without your committee's prior approval, invalidates your previously approved proposal and you may be required to change your work, write a new proposal, repeat the approval process, and/or find a new committee. So please stay in close communication with your committee members.

TIP: Very occasionally, students propose an ambitious capstone topic to attract faculty interest and establish a committee quickly. Then, after a proposal is approved, they request that their faculty reduce the proposal requirements because they have insufficient time or knowledge to complete it. Faculty members do not appreciate this type of "bait and switch." They typically cancel the capstone and permanently withdraw from the student's committee.

TIP: Capstone committee members commit to work with you for up to one (1) year after they approve your proposal. If you delay starting or take longer than a year to complete your work and have not been in communication with them, the faculty may decline to continue on your committee. If this occurs, you will need to form a new committee, and possibly develop a new proposal as well.

TIP: Again, if you have not worked on your capstone for an extended period of time and you need to maintain your active status plus have access to RIT resources, you may continue your capstone work by registering for either:
- *Continuation of MS Thesis*
- *Continuation of MS Project*

There is a one (1) credit-hour charge for registering for capstone continuation.

TIP: You should also be aware that if you have been inactive for eight (6) semesters or more, you could have been dematriculated from RIT. If this has occurred, your department may be able to reinstate you. However, if it's been over two years and degree requirements have changed, you must reapply for admission through RIT Graduate Enrollment Services. If you need to be readmitted and the degree requirements have

changed, you will be readmitted under the degree requirements that are currently in affect. This may mean that you need to do additional coursework in addition to completing your capstone. You should also be aware that you are subject to RIT's 7-year degree completion time limit (discussed under "Time Limits" below).

17. After you have completed your capstone work to the satisfaction of your committee, you will be ready to "defend" it in a public forum. The capstone defense is intended to allow you to demonstrate your expertise, skills, and professionalism within the context of your individual project or thesis. Your committee will set the requirements for the defense. However, it typically involves a formal presentation and, if applicable, a demonstration of your work. The defense may be done on-campus or from a distance. Your committee chair will make the arrangements (scheduling a time, getting a room, etc.) with the Student Services staff for your defense. Since your defense is open to the public, you will need to post an announcement for it <u>at least one week in advance</u> on the graduate bulletin board (see Appendix D for the posting format).

TIP: Your capstone faculty will tell you when you are ready to defend. Do not be tempted to push for an early defense or to announce a defense date without their approval. If you are allowed to defend before you are truly ready, you could fail the defense; be assigned additional work; and have to re-defend later when you are better prepared.

18. Your capstone document is <u>very</u> important. It represents your intellectual effort and professional capabilities. The faculty takes this document very seriously since they are required to sign off on it. Therefore you can expect to receive extensive feedback on both your technical content and writing style. Details on the capstone document format are included in Appendix A of this handbook; however, please be aware that your capstone faculty may require a different format. Ideally, whenever possible, your final capstone document should be available at the defense.

TIP: Your final capstone document <u>must</u> be of professional quality and written well, in terms of language usage, your expression of ideas, visual presentation, and references.

TIP: Presenting your committee with a well-written document will speed completion of the capstone requirement. Your committee members have many demands upon their time, so please do not expect them to provide extensive editing support. If writing is not one of your strengths, you will need to hire an editor to help you.

TIP: Appropriate references are critical to a well-written capstone document. Ideally, you should have a wide range of information sources: books, journals, etc. The Web is not a dependable source of reference material. If you do cite a reputable website, use an appropriate referencing format (see the APA, MLA and IEEE references in Appendix B) and print the opening page and all directly referenced pages for inclusion in an appendix to your document. The Web changes constantly, but your references <u>must</u> be "locatable."

TIP: If you receive feedback from your faculty that you should "clarify," "explain," or add "depth" to a section of your document, do so. If you're unsure what is meant by a comment or how to proceed, talk with them. Do not be tempted to just drop that section

from your document. Removing important content weakens your document, can aggravate your faculty and delay completion, and ultimately may negatively affect the evaluation of your work.

19. Your defense may result in further suggestions or changes that will need to be incorporated into your capstone work and/or documentation. You may also be required to defend more than once. However, once you have successfully passed your defense, the final step in the capstone process is to complete, bind, and submit your capstone work so that it may be permanently maintained by RIT.

TIP: When your capstone is successfully defended and your faculty members are satisfied with the capstone document, they will sign the official capstone signature page that must be bound into the front of all copies of your capstone document.

Capstone Grade

The MS capstone requirement is successfully completed when all work, the defense, and the capstone document have been completed to the satisfaction of your capstone faculty; it has been approved and signed off on by *all* of your capstone committee members; and the required copies of the capstone document have been appropriately bound and submitted per RIT and your department requirements.

After a MS project capstone is successfully completed, the members of the faculty committee award a letter grade of 'A', 'B', or 'C' based upon the student's demonstrated performance.

The MS thesis capstone is pass/fail and a grade of 'R' is assigned. When your faculty committee members accept the thesis, the name of the thesis is entered into the student's permanent academic record and it is considered "completed" at that point.

TIP: Satisfactory completion of the capstone requirement and the final grade is determined by agreement between all of your capstone committee members. This decision is based upon the quality of both your capstone work and your defense.

Binding & Submission

20. The final step in completing your capstone is to bind your capstone document for permanent retention by RIT. Minimally, this document must be formatted double-spaced with 1″ margins all around, page numbers, and a footer containing your name. Your capstone faculty may have additional formatting requirements. If you have any code, include it on storage media that can be bound into the back of your document.

You will need one copy of your document for each of your committee members and one copy for yourself. Plus, you need one additional copy for your department; and, if you do a thesis, the RIT Library also keeps a copy (but there is no cost to you for this).

Project capstone documents are permanently maintained by your department. They must be bound with a clear plastic cover on the front, a black plastic cover (with media pocket, if necessary) on the back, and black "continuous coil" binding – like a spiral notebook. This can be done at a Kinko's-type printing service; to locate a Kinko's near you, go to http://www.fedex.com/us/office/. Kinko's can also deliver your document to us for you.

Thesis capstone documents are maintained by both RIT's Wallace Library and your department. You make the copies; RIT handles the binding. There is a per-document binding charge. Information about the binding process, document requirements, and cost are available on the RIT website at http://library.rit.edu/webfm_send/54.

There is an additional RIT requirement for thesis completion: your thesis must be published in Proquest/UMI, a well-respected U.S. citation database, so that it is available to the academic community at large. There is no separate fee for this service. For information about the submission process, you should contact Jennifer Roeszies, at 585-475-2560 or jennifer.roeszies@rit.edu.

TIP: The capstone document (with any digital media) must be satisfactorily bound and submitted before you can be certified for degree completion and graduation. For a MS project capstone, this means that all copies of the final project document must be submitted to your department prior to certification. For an MS thesis capstone, the receipt for the binding from Student Financial Services and from your ProQuest/UMI submission must be returned to your department before you can be certified.

Sharing Your Efforts

21. You may want to share your scholarly efforts on the Web through an electronic theses and dissertation (ETD) site, through publication, or at a conference. Talk with your capstone faculty about this.

RIT's Digital Media Library (https://ritdml.rit.edu/dspace/) is one option. The Digital Media Library provides electronic documentation of graduate student projects, theses, and doctoral dissertations for the RIT community. The library will post your scholarship efforts or you can post it on your own. For more information see the website or contact the RIT Wallace Library

Alternately, you can find a relevant conference by talking with your committee faculty or on the Web at http://www.papersinvited.com.

TIP: This is an opportunity for you to begin to establish your professional credentials.

Time Limits

All requirements for the master's degree must be completed within seven (7) years of the START of the semester in which the first course that is used towards the MS degree was completed. This includes any credit for courses transferred from other universities. For example, if the oldest course on your MS worksheet was taken in the fall of 2012 (2121),

then your 7-year deadline would be prior to the start of fall 2018 (2181), or before September 2018.

Additionally, we strongly encourage students to finish their capstone work within one (1) year of the time that your graduate coursework is completed. Remember, your faculty committee is committed to your capstone topic for *one year only*; beyond that time frame it will be up to your committee members to decide whether or not they will continue with you. If they do agree to continue on your committee beyond the one-year time frame, your capstone proposal will have to be reviewed, and possible revisions to the original proposal or a new proposal may be required. Significant revisions may require finding a new committee since the revisions may alter the original proposal in such a way that the topic is no longer within the areas of expertise or interest of your faculty.

Collaborative Work

All capstone work for an MS degree at RIT is an underlined individual effort, even if contributing towards a collaborative project. The standard RIT and department academic honesty expectations and policies apply (http://www.rit.edu/studentaffairs/studentconduct/rr_academicdishonesty.php). Each department's academic dishonesty policy is also shown on its website.

TIP: The capstone is your opportunity to display your professionalism. Plagiarism and other acts of academic dishonesty have no place in this process and can have very serious consequences including dismissal from the institute sans degree. Be sure to do your own work and to appropriately and exhaustively reference all material obtained from outside sources.

TIP: Occasionally, a faculty member may define a development effort with multiple related components that a group of students can do to satisfy their capstone requirements. In such cases, each student will have an appropriate portion of the work defined as his or her capstone by the faculty member(s) involved, and will be solely responsible for his or her portion of the total effort.

Re-Use of Previous Course Work

A capstone may be an extension of work that you yourself started in one of your MS courses or that extends the capstone work of a previous student. However your capstone proposal must clearly document your idea as such, so that your faculty committee is aware of and approves of the origin of the idea and any previously completed work. Capstones that extend the work of your classmates, such as team or group course projects, are generally not acceptable unless specifically approved by your capstone committee.

TIP: Obviously since the capstone experience is an expectation beyond your MS coursework, projects or papers completed to satisfy assignments in courses taken during your studies either at RIT or at other academic institutions do not satisfy the capstone requirement, although as mentioned above, they may become the basis of it.

Appendix A
Sample Outlines[5]

Below are sample format outlines for capstone proposals and final documents. While the requirements of the final documentation are agreed upon between the student and his/her committee members, the following formats are a general standard. For both the project and thesis capstone options, the proposal and final document <u>must</u> follow either the APA, MLA or IEEE style guidelines (see Appendix B).

Project Proposal Outline (recommended)
- Topic Statement (state the problem you will investigate, including history and/or context)
- Significance (the importance of the topic and your interest in it; list, in detail, the concentration coursework and other experiences that will support your proposal)
- Proposed Solution and Deliverable(s) (list exactly what will be done; clearly and specifically describe exactly what the completed work will entail)
- Methodology (list the approach, techniques, and resources needed for implementation)
- Project Timeline or Schedule (anticipated; typically two semesters of effort)
- Supporting Research and References (relevant citations in appropriate format)

Thesis Proposal Outline (recommended)
- Hypothesis (hypothesis or assertion statements that clearly define the question to be investigated, the research that will be done, and the scope of your investigations)
- Significance (the importance of the topic and your interest in it; list, in detail, the concentration coursework and other experiences that will support your proposal)
- Literature Review (summarize the background literature that relates to your topic)
- Proposed Research and Deliverable(s) (list exactly what will be done; clearly and specifically describe exactly what the completed work will entail)
- Methodology (list the approach, techniques, and resources needed for implementation)
- Research (and development, if applicable) Timeline (anticipated; typically two semesters)
- Supporting Research and References (relevant citations in appropriate format)

Final Project or Thesis Documentation Format (recommended)
- Signed Project/Thesis Approval Form
- Title Page
- Copyright Page
- Abstract
- Table of Contents
- List of Tables, Charts, Illustrations, etc.
- Introduction
- Document Body (methods, results, discussion)
- Project/Thesis Conclusions (should reflect your personal thoughts on your work; minimally include results, all lessons learned, recommendations, and future tasks or suggestions for follow-up work)
- Appendices (charts, graphs, supplementary material, documentation of Web references)
- Supplemental Storage Media (with all development artifacts, if applicable)
- Bibliography

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[5] These outlines do not apply to MS/MI; MI students will learn about capstone details in 4006-887.

Appendix B
Writing Links & Other Helpful References

- **RIT Library:** http://library.rit.edu (Wallace; Building 05)
  - Graduate Student Support: http://library.rit.edu/graduate-student-support

- **Google Scholar:** http://scholar.google.com

- **Quoting:**
  http://owl.english.purdue.edu/handouts/research/r_quotprsum.html

- **Paraphrasing:**
  http://owl.english.purdue.edu/handouts/research/r_paraphr.html

- **Citations**:

  Various tools, guides and services are available through the Library at
  http://infoguides.rit.edu/citationguide and http://library.rit.edu/guides/widgets/web-widgets-library-research.html. Some of the more popular citation format guides are:

  APA Format: http://library.rit.edu/pubs/guides/apa6.pdf
  MLA Format: http://library.rit.edu/pubs/guides/mla.pdf
  IEEE Format: http://www.ieee.org/documents/stylemanual.pdf

- **Language Resources:**
  Guide to Grammar & Writing (includes structure and organization under Essay & Research Paper Level topic)
  http://grammar.ccc.commnet.edu/grammar/

- **RIT Academic Support Center - Writing Center** (SAU-1180)
  http://www.rit.edu/studentaffairs/asc/tutoring_writingcenter.php

- **Dictionary:**
  http://www.dictionary.com

- **Technical Dictionaries:**
  http://whatis.techtarget.com
  http://www.snia.org/education/dictionary/
  http://www.techweb.com/encyclopedia

- **Official Copies of Capstone Forms:**
  http://www.ist.rit.edu/?q=node/174 for MS/IT, MS/HCI
  http://nssa.rit.edu/?q=node/35   for MS/NSA, MS/CSIA

- **Thesis Binding & Publishing Information:**
  http://library.rit.edu/userservices/binding.html

Appendix C
Final Helpful Thoughts

Below are some suggestions, based on the personal experiences of your graduate coordinator, which can be used to make an open-ended capstone process go smoother.

- Nobody will "bug" you to complete your capstone work. You <u>must</u> be *self*-motivated!

- Be prepared to work <u>very</u> hard on your capstone.

- Start thinking of capstone ideas at the beginning of your program. Do not wait until the end of your study and say, "What should I do for my capstone?"

- An interesting topic discovered in a course or in a course project course may be the nucleus for a project or thesis. Write ideas down as they occur. That way you can review and develop them later.

- The project or thesis should build on the courses completed in your program of study. If you have a topic area of interest, then select your concentrations and electives to support the idea.

- Make a point of becoming acquainted with the faculty members who teach the courses in your areas of interest. Discuss your ideas with them and get their feedback on your ideas.

- After you have formed your faculty committee, work diligently on your project or thesis. Many graduate students approach the faculty, and they can lose interest in your capstone if you do not keep them regularly updated with your progress.

- Schedules are busy. Reserve time each week on a regular basis to work on your capstone. Don't plan to work on it whenever you have a few spare moments – you generally never do. Plan to reserve at least 4 – 8 hours per week to work on it. This is even more critical if you are now working and/or have a family.

- For on-campus students: while it is possible to complete your capstone from a distance, it is easier to complete it while you are still on campus.

- Complete the documentation for any software development as you write the code or do other implementation. It is easier, and will save time and effort later.

- Obtain feedback on the design of your project/thesis solution from your faculty committee members frequently – before it is difficult to make changes.

- Realize that faculty "turn-around" time for feedback on your work will be longer at busy times of the semester such as around mid-semester and finals. Also many faculty members have reduced availability during the summer term.

- While it takes a lot of hard work to complete the project or thesis, it is something that you can be proud of and can show perspective employers.

- Don't let yourself become discouraged. You are neither the first nor the last person to go through this process. Others have succeeded and you can too!