Final Assessment for SE 463
Summer 2020

Professor Daniel Berry

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Student Name

_____

Student Identification Number

_____

Student watIAM Login Name

In the immortal words of Daniel Berry

"Knock our socks off!"

Overall Instructions:

You have three hours from the opening of this assessment in which to complete the assessment and to submit it, by hitting the "Submit" button. You must upload any ***one*** file that you wish to be to considered part of your answers to the dropbox by the end of the same three-hour period. Note that the dropbox allows you upload only one file at a time. However, you may upload as often as you want; each new uploading replaces the previously uploaded file. Thus, if you have multiple files, you will have to merge them and upload them as a single merged file. Therefore, they need to be in the same format, e.g., PDF. Remember that all submissions and uploads are time stamped.

You have 180 minutes for 100 marks, for 1.8 minutes per mark. If you are registered with AccessAbility for more time in a final exam, then your submission deadline has been extended according to the formula provided by the AccessAbility office.

If you have questions about any question on the assessment, please ask Dan at <dberry@uwaterloo.ca> and <se463@student.cs.uwaterloo.ca>. Note that he is *not* glued to the computer the whole day and takes occasional 1/2 hour breaks. He is generally away from all computers between 5:00pm and 7:15pm EDT, and he is completely away from all computers between 11:00pm and 8:00am EDT to sleep. Since he does not hear the beep of e-mail arriving,

it's OK to e-mail him at any time :-). You will not awaken him! If you suspect that e-mail is not getting to him, tell him via WhatsApp at +49-151-5585-9119 that he has e-mail. If all else fails, you can try to ask a TA, but the TA may defer to Dan if he or she is not sure what to reply. Therefore, it is recommended that you try to overlap your three hours with the day time in EDT. Dan hopes that his having shared with you these instructions in advance of the final assessment will minimize your need to ask questions *during* the final assessment.

Please save your work frequently.

You are suggested to look at all questions before beginning to work on any of them so that you can budget your time carefully.

For each *whole* question, you may provide an answer either online or offline. By "whole question" is meant all of any of Questions 1, 2, 3, 4, and 5. The choice is not available for each subquestion, labeled "a", "b", etc., of a whole question. Thus, any one whole question must be answered entirely in one medium, of your choice.

Answering a question online means supplying your answer to the question directly in the answer window provided for the question by Learn.

If you choose to answer any question offline, then please download one of the various e-copies of the entire assessment using one of the links at the top of the "Introduction" window (the window you are reading now) of the home page for this assessment. One points to a PDF file, one points to a DOCX file, one points to an RTF file, and one points to a TXT file.

To answer questions offline, there are two choices --- DO NOT MIX CHOICES:

1. Work with a text editing app that you have on your computer on an e-copy of the final assessment:
   Using an app appropriate for the form of the file that you have downloaded, edit your answer directly into the downloaded file.
2. Work with pen or pencil on a hard copy of the assessment:
   Using an app appropriate for the form of the file that you have downloaded, print the downloaded file, and write your answers *carefully* directly on the printed copy. Any answers we cannot read will be marked "0". When you have finished writing your answers, scan or photograph it.

When you are done or time is up, upload the resulting file to the dropbox at Learn. Please try to upload the resulting file in PDF format rather than in the app's format.

If you choose to answer *all* questions online, then you do not have to upload any file to the dropbox.

The rest of this paragraph, until "END PAR", applies only if you are mixing online and offline answering.

- For each question answered offline, you must nevertheless indicate in the online Learn answer window for the question, "See uploaded file".
- For each question answered online, you must nevertheless indicate in the space for the question in the uploaded file, "See online quiz".

For clarity, therefore, if you choose to answer *all* questions offline, you must still submit the online quiz, having indicated in the online Learn answer window for each question, "See uploaded file".

END PAR

Even if you are taking the final assessment online, you might wish to download the PDF copy in order to see its layout on paper.

When a question asks you to identify X in a quoted artifact A,

- If you are answering online,
  - then probably the simplest thing is to copy the X from the A in the question and paste the copy into the Learn-provided answer window.
- If you are answering offline,
  - then, using the app for the e-copy or a pen or pencil, you somehow mark the parts of A that are X: Highlight them, boldface them, color them, or enclose them in one or more rectangles or drawn paths. Make sure that the person marking the question will have no problems determining what is and what is not identified.

When a question asks you to label an identified portion P with "Y",

- If you are answering online,
  - then probably the simplest thing is to insert "Y:" next to the P in the answer window.
- If you are answering offline,
  - then, using the app for the e-copy or a pen or pencil, you somehow label each piece of P with "Y". Type the text "Y" or write it close to each piece P. If the pieces of P are not contiguous, all pieces of P must have the same label "Y". Make sure that the person marking the question will have no problems determining what is and what is not so labeled.

Unlike the questions in past exams, each of which had very few correct answers, many questions in this assessment are quite open ended, each with an unbounded number of correct answers. Each question invites you to show all that you have learned in SE 463 that is *relevant* to the question. The *more of what you learned that is relevant* that you pull into your answer the better. Dan has prepared a rubric in which he lists for each question, all issues from SE 463 that he thinks is relevant for the question. If in fact, you think of a correct, relevant issue that is not on his list, you will earn *extra* points, on the grounds that you have taught Dan something he did not know! Indeed, in the questions asking for "as many as you can find" of something, you will find in parentheses how many Dan found so that you can know when to stop looking.

Do not be afraid to disagree with Dan on any issue. Just support your position with evidence from the course material or a *reliable* elsewhere. Your mark will be a function of the evidence that you give.

Concerning Technical Difficulties Submitting or Completing the Assessment:

If you encounter any difficulty submitting, grab screen shots of the windows with your answers and send them by e-mail to the course e-mail address, <se463@student.cs.uwaterloo.ca>, as soon as possible. If you encounter any difficulty uploading a file to the dropbox, then send the file you wished to upload by e-mail to the course e-mail address, <se463@student.cs.uwaterloo.ca>, as soon as possible. If the file is too big to send by e-mail, then upload it to <sendit.uwaterloo.ca> with <se463@student.cs.uwaterloo.ca> and <dberry@uwaterloo.ca> as recipients. You use your watIAM credentials to log on to <sendit.uwaterloo.ca>.

If you lose all Internet access, please send a text message through the cell phone network to Dan at +1-519-885-7222, stating that fact and giving your name, student number, where you are, and the *local time* (Remember that SMS messages are time stamped by the delivery time and not the sending time.). If you cannot even send a text message, then make voice call to Derek at +1-226-218-5243 and if there is no answer, leave a message with the same information. Do *not* attempt to call Dan's SMS number, as he is deaf.

Good luck! Knock our socks off!

Dan

Question 1 (30 marks = 54 minutes)

Recall the first e-mail, EM1, from Dan to all students, TAs, and professors involved in SE 463 on 1 July with a proposal for the final assessment that you are now taking.

EM1:
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Date: Wed, 1 Jul 2020 20:37:04 -0400 (EDT)
Subject: SE463 S20: Final Assessment Poll. PLS ANSWER BY FRIDAY 3 JULY 5pm EDT
Bcc: se463students, se463tas

Hi All in SE463 Spring 2020

Happy Canada Day!
We are trying to figure out how best to stage the final assessment.
We are thinking of something resembling a closed book, timed, and proctored in-person exam.
1. We would send a pdf of the exam say 30 minutes before it is to start.
2. You would print a hard copy where you are.
3. You would write the exam with pen or pencil, while being connected to a zoom meeting with a proctor who will ascertain that you are following normal closed-book final exam rules, and in particular are not using any online resources such as classmates. The proctor will be your TA or Dan or Derek, in the case of TAs with too many teams.
4. If you are registered with AccessAbility, the time for the exam will be adjusted according to the multiplier given to us by AccessAbility.
5. When you finish or time is up, you will scan or photograph your exam and email the scan or photo to the class e-mail address or to CrowdMark.
The purpose of this note is to request your feedback on the proposal, in particular to find out if ANYTHING about where you will be during the exam period prevents any part of the plan working for you.

Thanks
Stay Healthy
Dan

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This question has you do an analysis of the final assessment requirements as expressed in the e-mail from Dan with the help of the RE reference model and the Zave-Jackson Validation Formula (ZJVF), "D, S |- R".

This analysis will not be unlike the one that Dan did about his self-administered hair cut that is described in the "Real Life, Small Scale Requirements Engineering: A Covid-19 Era Self-Administered Haircut" section of the SE 463 Website.

a. Identify in EM1 and label with "R" the portions, if any, that constitute the R in "D, S |- R".

b. Identify in EM1 and label with "S" the portions, if any, that constitute the S in "D, S |- R".

c. There are many assumptions about the environment hidden in EM1 that are necessary for S to entail R. List as many *unique* assumptions as you can find (I found 13.). Give each unique assumption a unique label "D1", "D2", ...

D1:

D2:

Below is a representative subset of an anonymized summary of replies (ASR) sent by some of the students and TAs in response to EM1.

ASR:
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From: Student1
Date: Thu, 2 Jul 2020 00:42:57 +0000
I'm wondering what we are supposed to do if we lose wifi connection during the zoom meeting? I feel there are a number of things that could go wrong with this approach.
Is a proctored final exam the only option you're considering at this point? Would it not be more feasible to coordinate a timed assignment that we have a certain amount of hours to complete?

From: Student2
Date: Thu, 2 Jul 2020 01:05:41 +0000
Can the 30 minutes limit be extended a little bit? The reason is that I don't have a printer with myself so I need to go to my friends home to get one hard copy of it.

From: Student1
Date: Thu, 2 Jul 2020 01:10:38 +0000
Thank you for your message. Another concern is that my printer isn't all that reliable, so trying to print a hard copy of the exam may not work out if it malfunctions.

From: Student4
Date: Thu, 2 Jul 2020 01:32:25 +0000
Unfortunately I do not have access to a printer. The closest one is on campus in SLC which will take more than 30 mins to print and bring back home.
I would appreciate if the exam could be online where proctor can look at the screen via zoom screen sharing to make sure that the final is answered without cheating.

From: TA1
Date: Thu, 2 Jul 2020 02:22:29 +0000
Hi Dan,
In my opinion, a closed-book, Zoom-based exam is a lose-lose situation for everyone, but for the students especially, considering the standpoints of privacy and fairness.
In a Zoom-based exam, the students will feel negative because they're being glared at by proctors in their personal spaces, and the proctors (TAs) will feel negative because we will have to basically stare at a static image of a student (and can't walk around, look at other students, etc., like in a real exam environment).
Even if we explicitly state that we can give students the option for alternative arrangements, stating that the exam will be held over Zoom is a form of peer pressure, which will cause some to follow through in ways that are uncomfortable to them "because it's what the others are doing".

From a standpoint of fairness, expecting "closed-book"-ness and a time limit to level the playing field doesn't seem sufficient or practical in the variable environment of remote test-taking. Many undergrads are living in shared accommodation and it's not reasonable to expect that others won't be present in the same environment during the exam period. This puts students who don't have access to quiet environments at a disadvantage.

If I were in still undergrad and taking this class, I would like to see an exam that is "open-book", not monitored by Zoom, and is time-restricted, but to a longer period of time than a traditional exam. This would alleviate the privacy problems associated with Zoom, and help make things more fair given the current situation's impact on student's environments.

From: Student5
Date: Thu, 2 Jul 2020 14:28:01 +0000
I had a couple of questions:
1. How much time do we have between scanning and uploading after we are done with the exam?
2. If for any reason we lose internet connectivity during the exam, how do we deal with that?
Thank you.

From: Student6
Date: Thu, 2 Jul 2020 03:45:46 +0000
I don't have a printer at my place and I prefer not to purchase a printer just for the exam. Is it possible if I read the exam from my iPad or other devices while my laptop is connecting to a Zoom meeting?

From: Student10
Date: Thu, 2 Jul 2020 16:40:57 +0000
I have a bit of feedback on the proposed final assessment format. I have some classes which have done exams through timed Learn quizzes while others have done take home assessments. All the exams I've had this term which had tried to emulate traditional exams were poorly run and received a lot of negative response from students (technical difficulties, inadequate time due to having to type answers, etc.). The added stress of having to deal with technology during the exam makes it much more difficult. For me in particular, I do not have great internet and I often have to drop out of calls or meetings; I don't want to be seen as cheating in cases like this. It is also extremely difficult to find a quite place to work at home since I am often disturbed by family members.

From: Student12
Date: Thu, 2 Jul 2020 20:22:19 +0000

I do not currently have a working printer, I would be quite annoyed if I had to get one for this exam only...

From: Student13
Date: Fri, 3 Jul 2020 10:13:04 +0000
I had the following feedback regarding the final exam format:
For proctoring, I am assuming that there will also be a an exam time which is suited for students and proctors in the EST timezone. I am an international student and currently in India which means I am 0930 hours ahead and wont be able to work through the exam at a convenient time like everyone else.
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d. Let n be the number of domain assumptions that you found for (c) above. Identify in ASR and label with "Dn+1", "Dn+2", ..., as many portions of ASR as you can find (I found 5.) that imply some additional assumptions about the environment, not mentioned in your answer to (c) above, that are necessary for S to entail R. Each unique assumption should receive a unique label.

Then list the newly found "Dn+1", "Dn+2", ... labels, and write next to each "Di" a brief statement of the assumption implied by the text labeled by "Di".

D :

D :

e. Identify in ASR and label with "Emote" as many portions of ASR as you can find (I found 4.) that describe an emotional impact on the students who have to take the exam.

f. Identify in ASR and label with "MR" as many portions of ASR as you can find (I found 1.) that describe scope-determineD (D) requirements that are clearly *missing* from the "R" identified in your answer to (a) above.

g. Identify in ASR and label with "NR" as many portions of ASR as you can find (I found 3.) that describe scope-determininG (G) requirements that are new and that could *replace parts of, or augment,* the "R" identified in your answer to (a) above.

h. Instead of drawing a domain model of the world of the SE 463 final assessment as described by EM1, just list the name of all entities that you would put in the diagram. You may assume that there is a single entity named "S: Sys" that contains all system stuff that is hidden outside the interface part of the system. Thus, you should list only environment entities. Label with "E:" those entities that are in only the environment. Label with "SE:" those entities that are in the intersection of the environment and the system.

S: Sys

In the end, Dan decided that too many assumptions had too high a probability of not being true for the proposed final assessment plan to be implemented. He sent to the same recipients the e-mail, EM2, on 5 July describing what eventually became the assessment that you are taking now.

EM2:
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Date: Sun, 5 Jul 2020 21:59:12 -0400 (EDT)
Subject: SE463 S20: Final Assessment
Bcc: se463students, se463tas

Hi All in SE463 Spring 2020

Thanks to all of you, students and TAS, that responded to my request for problems with the plan for having a closed-book, timed, on-paper, and e-proctored final assessment. I assumed that the reason someone did not respond is that he or she has no problem with the plan.
It is clear from the responses that I received that the plan has many insurmountable difficulties. There are just too many exceptions to all the assumptions implicit in the plan, e.g., that the Internet stays up during the entire exam, that everyone is and can stay connected, that everyone has a printer, that everyone has a camera, that everyone will be awake at the exam time, etc.
Therefore, the final assessment will be open-book, timed from download, online (i.e., not on paper), and not proctored.
In retrospect, it was an interesting exercise in requirements analysis. Each of you and I is a stakeholder, and many of you identified assumptions and exceptions to these assumptions.
I will set a date range over which you will have 24 hours in which to do the download.

Stay Healthy

Dan
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i. Identify in EM2 and label with "R'" (notice the prime) the portions, if any, that constitute the R' in "D', S' |- R'".

j. Identify in EM2 and label with "S'" (notice the prime) the portions, if any, that constitute the S' in "D', S' |- R'".

Question 2 (25 marks = 45 minutes)

This question uses the same S and "D, S |- R" that are given in Question 1 and asks questions comparing them to a third S'' and "D, S'' |- R' " (original D, but new S'' and the second R'.

In fact, let S'' in "D, S'' |- R' " be a specification of the final assessment that you are currently taking, thus forgetting about the S' in EM2.

a. Which of the domain assumptions "D1", "D2", ..., "Dn", "Dn+1", "Dn+2", … are not solved by S'' and are thus still required to hold?

b. Thoroughly discuss the differences between S'', specifying the final assessment that you are currently taking and S, specifying the final assessment as originally conceived. Your answer should take into account

1. information in your answers to Question 1,
2. how well S and S'' mitigate or not the failure of parts of D to be true in the real world, and
3. the users', i.e., the students', likely feelings during the taking of the final assessments specified by S and S''.

Question 3 (30 marks = 54 minutes)

In SE 490--491, you will be the implementers of the system specified in your group's SE 463 Deliverable 5.

In (a) below, act as an implementer of this Deliverable 5 and evaluate the utility of the Deliverable 5 to *you*. (Please do not be afraid to answer truthfully as you see it. We really want to know what you really think. Your answer will not affect your Deliverable 5 grade. Your answer should focus on your needs as an implementer.)

a. Does the Deliverable 5 help you deliver a fully functioning implementation? Did Deliverable 5's authors' attempt to meet the acceptance criteria of the SE 463 staff lead to a document that helps address the problems that you believe you will face? If "yes", then how does it help you; if "no", then what is missing?

At the beginning of the term, in those *ancient* days of May 2020 (Do you remember that far back in time? :-)), Dan claimed that your Capstone project might be suffering from a common reality that plagues real-life software system developments:

CLAIM:
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So for your Capstone projects, you have been likely postponing working out the details of all requirements, because you don't have enough time.

You have probably picked a small viable set of G (scope determininG) requirements as the scope of your prototype and are heading into design and coding without having fleshed out the G requirements' D (scope determineD) requirements.

You don't have the time!

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You will answer either (b) or (c) below, not both.

Was Dan's claim true of your group? If your answer is "No", then answer (b); otherwise answer (c).

b. Write an essay explaining what your group was doing that allowed your group to have picked a scope and its G requirements and to have worked out completely all the D requirements for these G requirements. By appeal to material learned in SE 463, explain why what the group was doing helped to find and document all these requirements. Consider the following issues in your answer.

- Even though your group did not need the gift, did your group's doing the deliverables tell your group something about its Capstone project's requirements that your group did not already know? If so, what did you learn from each deliverable?
- And, did your group have to change its Capstone project's direction or scope as a result of what your group learned in doing the deliverables? If so, what was the change?
- Was doing any of the deliverables a waste of time? If so, which ones and why?
- (Do not be afraid to say what is on your mind. The mark will depend not on what you say, but how well you support what you say by appeal to what the course covered.)

Answering (c) below requires a little more background:

Dan said that SE 463 was going, through *its* term project, to give you the gift of time to work out these D requirements for your chosen G requirements for its Capstone project!

GIFT:
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And the way I am going to give you this time is to take advantage of my dictatorial powers of not giving you a passing grade in SE 463 unless you satisfy the course requirements, which is to write a requirements specification of the selected set of G requirements, the selected scope, of your capstone prototype, in which each of the scope's D requirements has been worked out and a response for it is specified.

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c. Did Dan succeed in giving the gift to your group? Regardless of your answer, write an essay answering this question. Consider the following issues in your answer.

- In doing the deliverables, what did your group do that it had not done before?
- What aspects of the development of your group's Capstone project were impacted by your group's doing the deliverables?
- How different do you think the current status your group's Capstone project would be today if your group had not done the deliverables?
- What did your group learn about its Capstone project's requirements from each deliverable?
- What was the most essential deliverable for the development of your group's Capstone project? and the least essential?
- Was doing any of the deliverables a waste of time? If so, which ones and why?
- (Do not be afraid to say what is on your mind. The mark will depend not on what you say, but how well you support what you say by appeal to what the course covered.)

Question 4 (10 marks = 18 minutes)

Two programmers, Bob and Alice following an agile lifecycle and are engaged in pair programming of a single module to their enhancement to Quest.

Bob (Mutttering out loud as he types): "GPA = sumOfGrades / numberOfCourses ;"

Alice: Hey Bob, you gotta check that "numberOfCourses" ain't zero!

B: Nah, never happens ....

A: What about *during* your first term as a student, before you've completed any course?

B: But then "sumOfGrades" is zero too!

A: So? it's still no good! 0/0 is undefined!!

B: OK, OK. (moves mouse to just above what he typed before and starts muttering again) "if numberOfCourses /= 0 {" return, tab ...

At this point, Bob and Alice's manager (M), who has been listening patiently while waiting for an opportunity to interrupt Bob and Alice to ask them a question, explodes in disgust: Wotta (What a) waste of time! Two people writing what one person could do all by themself! Bleah!!!!

M walks away without having asked her question.

a. What evidence from SE 463 materials would you remind M of to show her the flaw in her reasoning?

b. Pair programming can be thought of as conducting concurrently, both programming and what other activity that was covered among the topics of SE 463?

c. If Alice had not found the defect and Bob had delivered the code as he was writing it before Alice's comment, the resulting defect would be due to the failure to take into account what kind of requirement? D or G? Explain your answer.

Question 5 (5 marks = 9 minutes)

Consider the four sentences:

1. There's only enough for two.

2. There's enough only for two.

3. There's enough for only two.

4. There's enough for two only.

Below each unique pair, S1, S2, of the four sentences listed below, if the meanings of S1 and S2 are indistinguishable, write "indistinguishable"; otherwise write a new sentence, NS, that agrees with *one* of S1 and S2, but *not* the other, and then *say which* of S1 and S2, NS agrees with.

a.
1. There's only enough for two.
2. There's enough only for two.

b.
1. There's only enough for two.
3. There's enough for only two.

c.
1. There's only enough for two.
4. There's enough for two only.

d.
2. There's enough only for two.
3. There's enough for only two.

e.
2. There's enough only for two.
4. There's enough for two only.

f.
3. There's enough for only two.
4. There's enough for two only.