SE 101 Introduction to Methods of Software Engineering
Quiz #1

Prof. Jo Atlee   **Student name:**_____
October 23, 2003   **Student ID:**_____
10:30 a.m.   **Student Block Number:**_____
45 min.

This quiz is closed book, closed notes. No calculators are allowed. The quiz is double-sided. There are five (5) questions, worth a total of 65 marks. Show your work to receive partial credit for incorrect answers.

1. (5 marks) Software Engineering
Explain to a non-technical person what the discipline of software engineering is all about. Restrict your answer to 2-3 sentences.

Software Engineering applies computer-science knowledge and engineering principles, processes, and discipline, to develop software applications that are reliable, maintainable, and economical.

2. (10 marks) Error Propagation
Suppose you make the following timed measurements in a lab:

50 ± 10 s
55 ± 10 s
52 ± 10 s

a) Express the above three measurements and their uncertainties in scientific notation, to the appropriate number of significant digits.

$(5 \pm 1) \times 10^1$ s
$(6 \pm 1) \times 10^1$ s
$(5 \pm 1) \times 10^1$ s

b) Compute the sum of the three measurements, and express the result including the uncertainty in scientific notation, to the appropriate number of significant digits.

$((5+6+5) \pm (1+1+1)) \times 10^1$ s $=$
$(16 \pm 3) \times 10^1$ s

3. (10 marks) Design process

a) Name five steps in the Engineering Design process, as described in the IPE text or in the Software Engineering waterfall development process.

b) For each of the five steps that you name, state which activity in the following scenario corresponds to that step.

Sven wants to do something for Thanksgiving. He invites ten friends over to his house for a potluck dinner (i.e., a dinner in which every guest brings a dish). Because of the size of the event, Sven treats it as an engineering problem. He asks each of his friends to tell him what they would like to bring, and also asks if anyone has any dietary restrictions. Two guests say that they are vegetarians, one guest says she has a nut allergy, and one guest says he is trying to cut down on eating fat. Four guests offer to bring mashed potatoes, three guests offer to bring yams, and three guests each offer to bring a pie; no one offers to bring turkey, stuffing, green vegetables, or a vegetarian entrée. Sven decides he will make the turkey. He asks the two vegetarians if they would each be willing to bring a vegetarian entrée, instead of the dish they had offered to bring. He asks two of the guests who offered to bring mashed potatoes if they would instead bring stuffing and cranberry sauce. He asks two of the guests who offered to bring yams if they would instead bring a green vegetable and a salad. Sven asks to see everyone's recipes ahead of time, so each guest looks through his or her recipe books, selects one or two possible recipes, and sends them to Sven. Sven reviews the recipes, to make sure that there will be enough food for everyone – especially the vegetarians, the low-fat dieter, and the guest with the nut allergy. Sven chooses among the recipes and sends his selections back to the guests. He also sends a note to the guests, saying that the dishes they propose to bring all look delicious. On Thanksgiving Day, everyone brings to Sven's house a tremendous amount of food. Everyone has a great time and leaves stuffed.

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Recognition of need	Sven wants to do something for Thanksgiving
Definition of problem	Sven decides to invite friends over for dinner. Decides on 10 friends, and potluck dinner.
Definition of design criteria	Dinner must include dishes for vegetarians and guest with nut allergy; should strive for some low-fat dishes
Design loop – synthesis	Guests offer to bring types of dishes
Design loop – analysis	Sven compares offered dishes with his idea of what a Thanksgiving meal ought to include
Design loop – decision-making	Sven asks some guests to revise what dishes they plan to bring
Design loop – synthesis (2nd)	Guests select recipes
Design loop – analysis (2nd)	Sven reviews recipes to ensure that there will be
Optimization	enough food for everyone, including those with dietary restrictions
Design loop – decision-making (2nd)	Sven approves final recipes
Evaluation	
Communication	Sven communicates final recipe choices to guests
Manufacturing	Guests make dishes
Field service	<none>

(3 marks) BONUS QUESTION: Would either the concurrent-engineering development process or agile methods have helped Sven to settle on a menu more quickly? If so, explain how. If not, explain why not. Answer this question for only one of these two processes. Keep your answer to two or three sentences.

Concurrent engineering – Sven could ask guests to respond to invitation with proposed dishes. Scenario does overlap definition of design criteria and synthesis, by asking guests about both in the same message. Sven could make some decisions about proposed dishes as he receives them, rather than waiting for responses from all guests to do analysis.

Agile methods – Sven's problem isn't decomposable into sub-problems that are solvable incrementally, so his problem is not amenable to agile methods.

4. (10) Planning
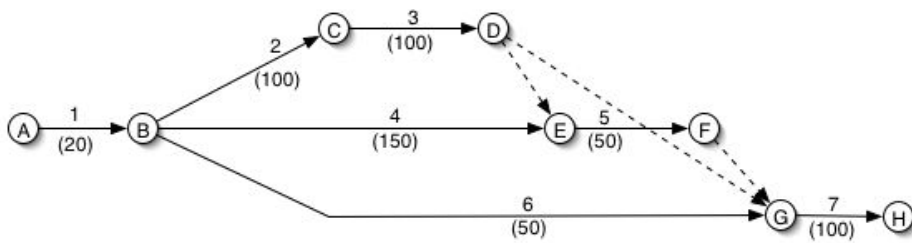
Consider the above arrow diagram for a programming project with the following activities and their estimated times:

1. Divide project into tasks   20 hrs
2. Design and implement Task A   100 hrs
3. Test Task A   100 hrs
4. Design and implement Task B   150 hrs
5. Integrate and test Task B   50 hrs
6. Design and implement Task C   50 hrs
7. Integrate and test Task C   100 hrs

a) List the events that lie along the critical path in the above arrow diagram.

Critical path is the longest path from A to H
A-B-C-D-E-F-G-H = 20+100+100+50+100 = 370
A-B-C-D-G-H is a sub-path of the above, so would not be longer
A-B-E-F-G-H = 20+150+50+100 = 320
A-B-G-H = 170
∴ critical path is A-B-C-D-E-F-G-H

b) What is the latest event time for event D?

H-G-F-E-D = 100+50 = 150
H-G-D = 100
LE = Total time – longest path from D to H = 370-150 = 220

5. (30) Grammar
Below are three pieces of text, each of which has four or five types of grammatical errors and may have multiple instances of some grammatical errors. You are to correct all instances of grammatical errors by marking up the text.

a) (5 types of errors)

In the event of a strike by the Carleton University Academic Staff Association~~:~~

- ~~s~~Some courses will be cancelled until the strike ends~~.~~
- ~~c~~Courses that are taught by sessional lecturers, or by faculty who choose to continue to work, will meet as scheduled~~.~~
- ~~c~~<u>Students will be expected to c</u>ross the picket line and attend any classes that are being held~~.~~
- ~~t~~The library will be open, although there may be reduced service~~.~~
- ~~r~~Residence and food service will operate as usual~~.~~
- ~~c~~Computer labs will remain open and operate as usual~~.~~
- ~~s~~Students will not receive any tuition refund. When the strike ends, <u>students will complete</u> ~~courses will be completed~~ and ~~students~~ will receive full credit for their courses.

b) (4 types of errors)

Biting Asian ladybugs thrive and multiply when there is an infestation of tiny, green, soybean aphids~~.~~~~.~~ ~~t~~This <u>boom in ladybug population</u> results in an invasion of ladybugs in urban areas, once the soybeans ~~have been~~<u>are</u> harvested and the ~~ladybug's~~<u>ladybugs'</u> food supply suddenly disappears.

c) (4 types of errors)

To vote in Waterloo's up~~-~~coming municipal elections, ~~the qualifications are that~~ you must be a Canadian citizen<u>;</u>~~,~~ you must be at least 18 years old on November 10<u>,</u> 2003<u>;</u>~~,~~ and you must be a resident or a tenant in the City of Waterloo.

(2 marks) BONUS QUESTION
Under what circumstances is *compromise*, as a decision-making strategy, more appropriate than *consensus*? Be brief (1-2 sentences).

<u>*Compromise* is the better strategy if you want all stakeholders to be equally happy (or unhappy) with a decision, but there is not enough time to devise by *consensus* a more appropriate alternative that would satisfy everyone's needs.</u>