

Name: _____

MSWE 609 Midterm Answers October 20, 1999

Note: The following are all ideas that can be used for answering these questions. There is no one right answer. The idea was to see if you can think of your own rationale why these concepts are so.

Answer all questions in the answer book. Keep each answer relatively short. Not more than a short paragraph is needed for any answer. If you find yourself writing too much, you don't understand the question being asked. All opinions must be backed up with relevant facts. Some of these questions can be answered both by "yes" and "no" depending upon what facts are used to justify your opinion.

Each question has the same value, even though some questions are harder than others.

1. A lines of code metric closely correlates with most other size metrics. If so, why do we need to consider other size metrics? Would a lines of code number be sufficient? Agree or disagree with this argument by giving cogent comments about it.

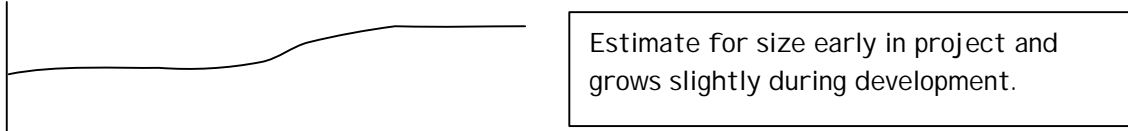
Some reasons:

Lines of code still very inaccurate. Still need better estimates.

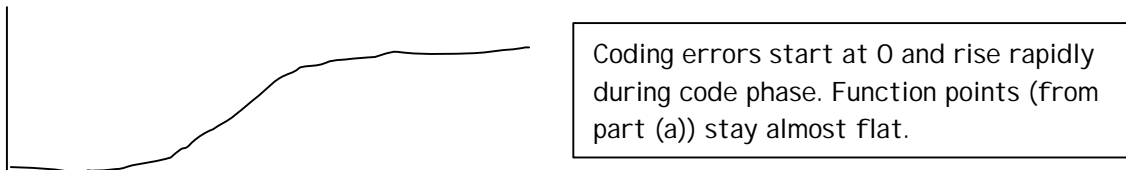
Lines of code generally tracks other measures, so a reasonable estimator.

Lines of code only ready after end of development. Need predictive measures also.

2. What will the following two graphs approximately look like? Give a short statement to justify each answer.
(a) Function points in a project versus time (by weeks)



- (b) (Source coding errors)/(function points) versus time (by weeks)



3. In a requirements document, the following measure is proposed as a system complexity metric: Number of "e"s in the requirements document. Comment on the applicability of this measure as a complexity measure.

Number of "e"s is a measure of size of document. Since size is roughly correlated with complexity, it is an approximate measure of complexity.

4. What is the cyclomatic complexity of the following program fragments?

(a) IF A=B THEN
 X := 7;
 Y := C+D;
 WHILE X<Y DO
 X:=X+1;
 Z:= X+Y
 END WHILE;

(b) IF A=B THEN
 X := 7;
 Y := C+D;
 X:=Y;
 END IF;
 WHILE X<Y DO
 X:=X+1;

Name: _____

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X:=Y;  
END IF;
```

```
Z:= X+Y  
END WHILE;
```

Cyclomatic complexity is number of decisions+1 which is 3 in both cases.

5. Consider the program code:

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A = A+B + C
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- (a) What are the various parameters and the computed size of the program using the software science measures?

Parameters are number of operands (n_1) = 3 (A, B, C) and number of operators (n_2) = 2 (+, =).
Size is $n_1 \log n_1 + n_2 \log n_2 = 3 \log 3 + 2 \log 2 = 3 \log 3 + 2$ approx $4.5 + 2 = 6.5$.

- (b) How does it compare with the actual value?

Actual value = 7 tokens for $A=A+B+C$

6. Comment on the value of the cyclomatic complexity measure as a program complexity measure. (Use problem 4 as a guide.)

Most view 4(a) as more complex than 4(b) since it is a nested decision structure where 4(b) is just 2 sequential decisions. But both have same cyclomatic complexity of 3.

7. Redwine and Riddle claim that technology maturation can take up to a generation (17 to 25 years) while Zelkowitz in his study of technology transfer at NASA claims that technology infusion can take from 4 to 6 years. Explain the discrepancy in these two time periods.

Technology maturation is time to pass through an entire industry whereas technology infusion is time to install a new technology in a single company. Infusion is 4-6 years typically, maturation is 18-25.

8. Explain what each of the following mean and give an example of each:

- (a) An in vitro exploratory experiment

A laboratory experiment of a new technology such as a group of students trying a new technology, e.g., a reading inspection study.

- (b) An in vivo confirmatory experiment

Trying an experiment in the field, e.g., a case study in the NASA Software Engineering Laboratory trying some new technology on spacecraft software.

9. For the COCOMO model:

- (a) What is its greatest strength and why?

Widely used.

Simple theoretical model.

Lots of data from other users.

- (b) What is its greatest weakness and why?

No scientific validation of underlying model.

Model highly dependent on individual environments.

Name: _____

10. Comment on each of the following:

(a) Software engineering is a science.

Lack of experimental paradigm.

Lack of hypotheses, theories and laws.

(b) Software engineering is engineering.

Lack of quantification of models.

11. "The CK OO metrics can only be used with a language that supports classes, such as C++. It cannot be used in a non-OO language such as C." Comment on this statement.

Need inheritance to properly use CK OO metrics.

Consider the following 4 measures:

- Function points
- Cyclomatic complexity
- Lines of code
- Software science

12. Which of the above 4 measures is probably the best predictor of the overall cost of a software development and why?

Function points probably best answer. A reasonable estimate that can be made early in a project's lifetime.

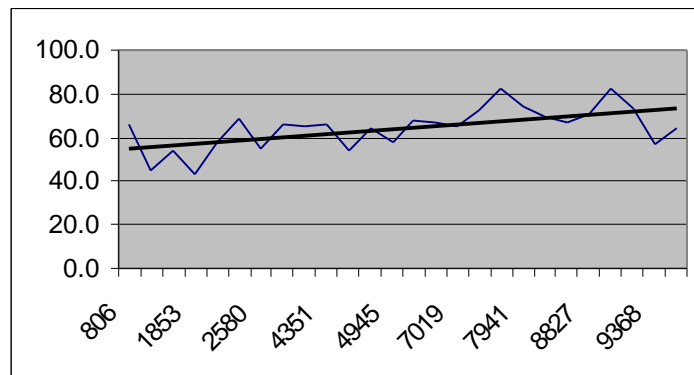
13. Which of the above 4 measures is probably the best evaluator of the overall cost of a software development and why?

Lines of code a reasonable estimate at end.

14. Which of the above 4 measures is probably the best predictor of the eventual defect rate in a software development and why?

Lines of code or software science both have defect rate models. Function points probably worst choice. Cyclomatic complexity could be answer if a good explanation of cyclomatic complexity and defects.

15. Consider the following graph:



Name: _____

- (a) The points on the graph have a .63 correlation with the straight regression line on the graph. What can you say about the regression line being a measure of the raw data?

Not much. Both attributes (X and Y axes) are related to one another with approximately 40% agreement.

- (b) It turns out that this is a graph of low order 4 digits of social security numbers versus final class average for a previous CMSC class. What can you now say about the relationship of the regression line and the raw data?

This shows the difference between correlation and cause-effect. One is not a cause of the the other. It is an incidental relationship.

16. Consider the 4 scales: nominal, ordinal, interval, ratio. For each of the following, what scale does it represent and why?

- (a) Your grade on this exam (from 0 to 100).

Ratio - since twice the grade is twice the "knowledge." - at least in theory.

- (b) Your grade in this course (A, B, C, D, F)

Ordinal - A is better than B which is better than C ...

- (c) The number of miles from your home to the university

Ratio - Twice the miles is twice the relative distance from home.

- (d) Your social security number

Nominal - Number is a unique identifier of you, nothing more. Although you can say the first 3 digits do represent the area you registered in. That would still be nominal.