

CS 350: Assignment Kit for Program 4

Fall 2005

Version 1 (subject to change)

Personal Software Process

Assignment Kit for Program 4

Overview

Overview

This assignment kit covers the following topics.

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Prerequisites

Reading
• Chapters 10 and 11

Program 4 requirements

Program 6 requirements

Using PSP2.1, write a program to find the value of x for which integrating the t function from 0 to x gives a result of p .

Thoroughly test the program. At a minimum, calculate the values for the t -distribution integral for the values in Table 1. Expected values are also included in Table 1.

Test		Expected Value	Actual Value
p	dof	x	
0.20	6	0.553380924	
0.45	15	1.753050325	
0.495	4	4.604094871	

Table 1

Search algorithm

Finding the value of x

Find the value of x for which integrating the t function from 0 to x gives a result of p .

- Start with a trial value for upper limit of 1 and calculate the value of the integration.
- Compare it to the desired value.
 - if the result of the integration is too low, pick a larger trial upper limit
 - if the result of the integration is too high, pick a smaller trial upper limit

Make successive trial integrations until the value of the integration is within an acceptable error, say 0.00001.

One way to make this calculation is as follows.

Step	Action
1	Start with a trial value of x (for example, 1.0).
2.	Make an initial integral and test to see if it gives a proper value; if not, continue.
3.	If it is too low, add $d = 0.5$ to trial x .
4.	If it is too high, subtract $d = 0.5$ from trial x .
5.	Integrate again and test if the result is within an acceptable error; if not, continue.
6.	If too low, adjust d ; add d to trial x .
7.	If too high, adjust d ; subtract d from trial x .
8.	Recycle at 5.

The rules for adjusting d are these.

1. As long as the tests for the error of the result give the same sign of the error, leave d unchanged.
2. Whenever the sign of the error changes, divide d by 2.

Note that this method of adjusting d could result in a trial value of $x = 0$.

To guard against a problem with Simpson's method, ensure that the program will handle a 0 value of the function being integrated.

Assignment instructions

Assignment instructions

Before starting program 4, review the top-level PSP2.1 process script below to ensure that you understand the “big picture” before you begin. Also, ensure that you have all of the required inputs before you begin the planning phase.

PSP2.1 Process Script

Purpose	To guide the development of module-level programs	
Entry Criteria	<ul style="list-style-type: none"> - Problem description - PSP2.1 Project Plan Summary form - Size Estimating template - Historical size and time data (estimated and actual) - Time and Defect Recording logs - Defect Type, Coding, and Size Measurement standards - Stopwatch (optional) 	
Step	Activities	Description
1	Planning	<ul style="list-style-type: none"> - Produce or obtain a requirements statement. - Use the PROBE method to estimate the added and modified size. - Omit computing <i>the size prediction interval</i> for now. - Complete the Size Estimating template. - Use the PROBE method to estimate the required development time. - Omit computing <i>the time prediction interval</i> for now. - Complete a Task Planning template. - Complete a Schedule Planning template. - Enter the plan data in the Project Plan Summary form. - Complete the Time Recording log.
2	Development	<ul style="list-style-type: none"> - Design the program. - Omit the use of <i>design templates</i> but provide a design in a format of your choice. Pseudo-code is acceptable - Review the design, and fix and log all defects found. - Implement the design. - Review the code, and fix and log all defects found. - Compile the program, and fix and log all defects found. - Test the program, and fix and log all defects found. - Complete the Time Recording log.
3	Postmortem	Complete the Project Plan Summary form with actual time, defect, and size data.
Exit Criteria	<ul style="list-style-type: none"> - A thoroughly tested program - Completed Project Plan Summary form with estimated and actual data - Completed Size Estimating and Task and Schedule Planning templates - Completed Design - Completed Test Report template - Completed PIP forms - Completed Time and Defect Recording logs 	

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Assignment instructions, Continued

Planning phase Plan program 4 following the PSP2.1 planning phase and the PROBE estimating scripts.

PSP2.1 Planning Script

Purpose	To guide the PSP planning process
Entry Criteria	<ul style="list-style-type: none"> - Problem description - PSP2.1 Project Plan Summary form - Size Estimating, Task Planning, and Schedule Planning templates - Historical size and time data (estimated and actual) - Time Recording log

Step	Activities	Description
1	Program Requirements	<ul style="list-style-type: none"> - Produce or obtain a requirements statement for the program. - Ensure that the requirements statement is clear and unambiguous. - Resolve any questions.
2	Size Estimate	<ul style="list-style-type: none"> - Produce a program conceptual design. - Use the PROBE method to estimate the added and modified size of this program. - Complete the Size Estimating template and Project Plan Summary form. - Omit <i>calculating the 70% size prediction interval. (You may use a spreadsheet.)</i>
3	Resource Estimate	<ul style="list-style-type: none"> - Use the PROBE method to estimate the time required to develop this program. - Omit <i>calculating the 70% size prediction interval. (You may use a spreadsheet.)</i> - Using the <i>To Date %</i> from the most recently developed program as a guide, distribute the development time over the planned project phases.
4	Task and Schedule Planning	For projects lasting several days or more, complete the Task Planning and Schedule Planning templates.
5	Defect Estimate	<ul style="list-style-type: none"> - Based on your to-date data on defects per added and modified size unit, estimate the total defects to be found in this program. - Based on your <i>To Date %</i> data, estimate the number of defects to be injected and removed by phase.

Exit Criteria	<ul style="list-style-type: none"> - Documented requirements statement - Program conceptual design - Completed Size Estimating template - For projects lasting several days or more, completed Task and Schedule Planning templates - Completed Project Plan Summary form with estimated program size, development time, and defect data - Completed Time Recording log
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Verify that you have met all of the exit criteria for the planning phase, then proceed to the development phase.

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Assignment instructions, Continued

Use the PROBE method to create size and resource estimates.

Purpose	To guide the size and time estimating process using the PROBE method
Entry Criteria	<ul style="list-style-type: none"> - Requirements statement - Size Estimating template and instructions - Size per item data for part types - Time Recording log - Historical size and time data
General	<ul style="list-style-type: none"> - This script assumes that you are using added and modified size data as the size-accounting types for making size and time estimates. - If you choose some other size-accounting types, replace every “added and modified” in this script with the size-accounting types of your choice.

Step	Activities	Description
1	Conceptual Design	Review the requirements and produce a conceptual design.
2	Parts Additions	Follow the Size Estimating Template instructions to estimate the parts additions and the new reusable parts sizes.
3	Base Parts and Reused Parts	<ul style="list-style-type: none"> - For the base program, estimate the size of the base, deleted, modified, and added code. - Measure and/or estimate the size of the parts to be reused.
4	Size Estimating Procedure	<ul style="list-style-type: none"> - If you have sufficient estimated proxy size and actual added and modified size data (three or more points that correlate), use procedure 4A. - If you do not have sufficient estimated data but have sufficient plan added and modified and actual added and modified size data (three or more points that correlate), use procedure 4B. - If you have insufficient data or they do not correlate, use procedure 4C. - If you have no historical data, use procedure 4D.
4A	Size Estimating Procedure 4A	<ul style="list-style-type: none"> - Using the linear-regression method, calculate the β_0 and β_1 parameters from the estimated proxy size and actual added and modified size data. - If the absolute value of β_0 is not near 0 (less than about 25% of the expected size of the new program), or β_1 is not near 1.0 (between about 0.5 and 2.0), use procedure 4B.
4B	Size Estimating Procedure 4B	<ul style="list-style-type: none"> - Using the linear-regression method, calculate the β_0 and β_1 parameters from the plan added and modified size and actual added and modified size data. - If the absolute value of β_0 is not near 0 (less than about 25% of the expected size of the new program), or β_1 is not near 1.0 (between about 0.5 and 2.0), use procedure 4C.
4C	Size Estimating Procedure 4C	If you have any data on plan added and modified size and actual added and modified size, set $\beta_0 = 0$ and $\beta_1 = (\text{actual total added and modified size to date} / \text{plan total added and modified size to date})$.
4D	Size Estimating Procedure 4D	If you have no historical data, use your judgment to estimate added and modified size.

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Assignment instructions, Continued

PROBE Estimating Script (Continued)

Step	Activities	Description
5	Time Estimating Procedure	<ul style="list-style-type: none"> - If you have sufficient estimated proxy size and actual development time data (three or more points that correlate), use procedure 5A. - If you do not have sufficient estimated size data but have sufficient plan added and modified size and actual development time data (three or more points that correlate), use procedure 5B. - If you have insufficient data or they do not correlate, use procedure 5C. - If you have no historical data, use procedure 5D.
5A	Time Estimating Procedure 5A	<ul style="list-style-type: none"> - Using the linear-regression method, calculate the β_0 and β_1 parameters from the estimated proxy size and actual total development time data. - If β_0 is not near 0 (substantially smaller than the expected development time for the new program), or β_1 is not within 50% of $1/(\text{historical productivity})$, use procedure 5B.
5B	Time Estimating Procedure 5B	<ul style="list-style-type: none"> - Using the linear-regression method, calculate the β_0 and β_1 regression parameters from the plan added and modified size and actual total development time data. - If β_0 is not near 0 (substantially smaller than the expected development time for the new program), or β_1 is not within 50% of $1/(\text{historical productivity})$, use procedure 5C.
5C	Time Estimating Procedure 5C	<ul style="list-style-type: none"> - If you have data on estimated – added and modified size and actual development time, set $\beta_0 = 0$ and $\beta_1 = (\text{actual total development time to date}/\text{estimated} - \text{total added and modified size to date})$. - If you have data on plan – added and modified size and actual development time, set $\beta_0 = 0$ and $\beta_1 = (\text{actual total development time to date}/\text{plan total added and modified size to date})$. - If you only have actual time and size data, set $\beta_0 = 0$ and $\beta_1 = (\text{actual total development time to date}/\text{actual total added and modified size to date})$.
5D	Time Estimating Procedure 5D	If you have no historical data, use your judgment to estimate the development time from the estimated added and modified size.
6	Time and Size Prediction Intervals	<ul style="list-style-type: none"> - If you used regression method A or B, calculate the 70% prediction intervals for the time and size estimates. - If you did not use the regression method or do not know how to calculate the prediction interval, calculate the minimum and maximum development time estimate limits from your historical maximum and minimum productivity for the programs written to date.
Exit Criteria		<ul style="list-style-type: none"> - Completed estimated and actual entries for all pertinent size categories - Completed PROBE Calculation Worksheet with size and time entries - Plan and actual values entered on the Project Plan Summary

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Assignment instructions, Continued

Development phase

Develop the program following the PSP2.1 development phase script.

PSP2.1 Development Script

Purpose	To guide the development of small programs	
Entry Criteria	<ul style="list-style-type: none"> - Requirements statement - Project Plan Summary form with estimated program size and development time - For projects lasting several days or more, completed Task Planning and Schedule Planning templates - Time and Defect Recording logs - Defect Type standard and Coding standard 	
Step	Activities	Description
1	Design	<ul style="list-style-type: none"> - <i>Produce a design to meet this specification.</i> - <i>Record the design an appropriate form..</i> - Record in the Defect Recording log any requirements defects found. - Record time in the Time Recording log.
3	Code Review	<ul style="list-style-type: none"> - Follow the Code Review script and checklist and review the code. - Fix all defects found. - Record defects in the Defect Recording log. - Record time in the Time Recording log.
4	Compile	<ul style="list-style-type: none"> - Compile the program until there are no compile errors. - Fix all defects found. - Record defects in the Defect Recording log. - Record time in the Time Recording log.
5	Test	<ul style="list-style-type: none"> - Test until all tests run without error. - Fix all defects found. - Record defects in the Defect Recording log. - Record time in the Time Recording log. - Complete a Test Report template on the tests conducted and the results obtained.
Exit Criteria	<ul style="list-style-type: none"> - A thoroughly tested program that conforms to the Coding standard - <i>Completed Design</i> - Completed Test Report template - Completed Time and Defect Recording logs 	

Verify that you have met all of the exit criteria for the development phase, then proceed to the postmortem phase.

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Assignment instructions, Continued

Assignment instructions, Continued

Postmortem phase Conduct the postmortem following the PSP2.1 postmortem script.

PSP2.1 Postmortem Script

Purpose	To guide the PSP postmortem process	
Entry Criteria	<ul style="list-style-type: none"> - Problem description and requirements statement - Project Plan Summary form with program size, development time, and defect data - For projects lasting several days or more, completed Task Planning and Schedule Planning templates - Completed Test Report template - Completed Design templates - Completed Design Review and Code Review checklists - Completed Time and Defect Recording logs - A tested and running program that conforms to the coding and size measurement standards 	
Step	Activities	Description
1	Defect Recording	<ul style="list-style-type: none"> - Review the Project Plan Summary to verify that all of the defects found in each phase were recorded. - Using your best recollection, record any omitted defects.
2	Defect Data Consistency	<ul style="list-style-type: none"> - Check that the data on every defect in the Defect Recording log are accurate and complete. - Verify that the numbers of defects injected and removed per phase are reasonable and correct. - Determine the process yield and verify that the value is reasonable and correct. - Using your best recollection, correct any missing or incorrect defect data.
3	Size	<ul style="list-style-type: none"> - Count the size of the completed program. - Determine the size of the base, reused, deleted, modified, added, total, added and modified, and new reusable code. - Enter these data in the Project Plan Summary form.
4	Time	<ul style="list-style-type: none"> - Review the completed Time Recording log for errors or omissions. - Using your best recollection, correct any missing or incomplete time data.
Exit Criteria	<ul style="list-style-type: none"> - A thoroughly tested program that conforms to the coding and size measurement standards - Completed Design templates - Completed Design Review and Code Review checklists - Completed Test Report template - Completed Project Plan Summary form - Completed PIP forms describing process problems, improvement suggestions, and lessons learned - Completed Time and Defect Recording logs 	

Verify that you have met all of the exit criteria for the PSP2.1 postmortem phase, then submit your assignment.

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Assignment instructions, Continued

Submitting your assignment

When you've completed the postmortem phase, submit your assignment package, source code, and test results to the instructor.

The order for the assignment package is

- PSP2.1 Project Plan Summary form
 - Test Report template
 - PIP form
 - Size Estimating template
 - PROBE Calculation worksheet
 - Time Recording log
 - Defect Recording log
 - source program listing
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Guidelines and evaluation criteria for program 4

Evaluation criteria

Your process report must be

- complete
- legible
- in the specified order

Your process data must be

- accurate
- precise
- self-consistent

Due dates

Initial project plan: Oct. 3

Completed project: Oct. 8 (but no penalty if turned in by Oct. 13)

Suggestions

Keep your programs simple. You will learn as much from developing small programs as from large ones.

If you are not sure about something, ask for clarification.

Software is not a solo business, so you do not have to work alone.

- You must, however, produce your own estimates, designs, code, and completed forms and reports.
 - You may have others review your work, and you may change it as a result.
 - You should note any help you receive from others in your process report. Log the review time that you and your associates spend, and log the defects found or any changes made.
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