

C A L T E C H

Project Management and Software Development

Exercise Guide

for Boeing Satellite Systems

California Institute of Technology
Industrial Relations Center
383 South Hill Avenue
Pasadena, California
626 395-2348

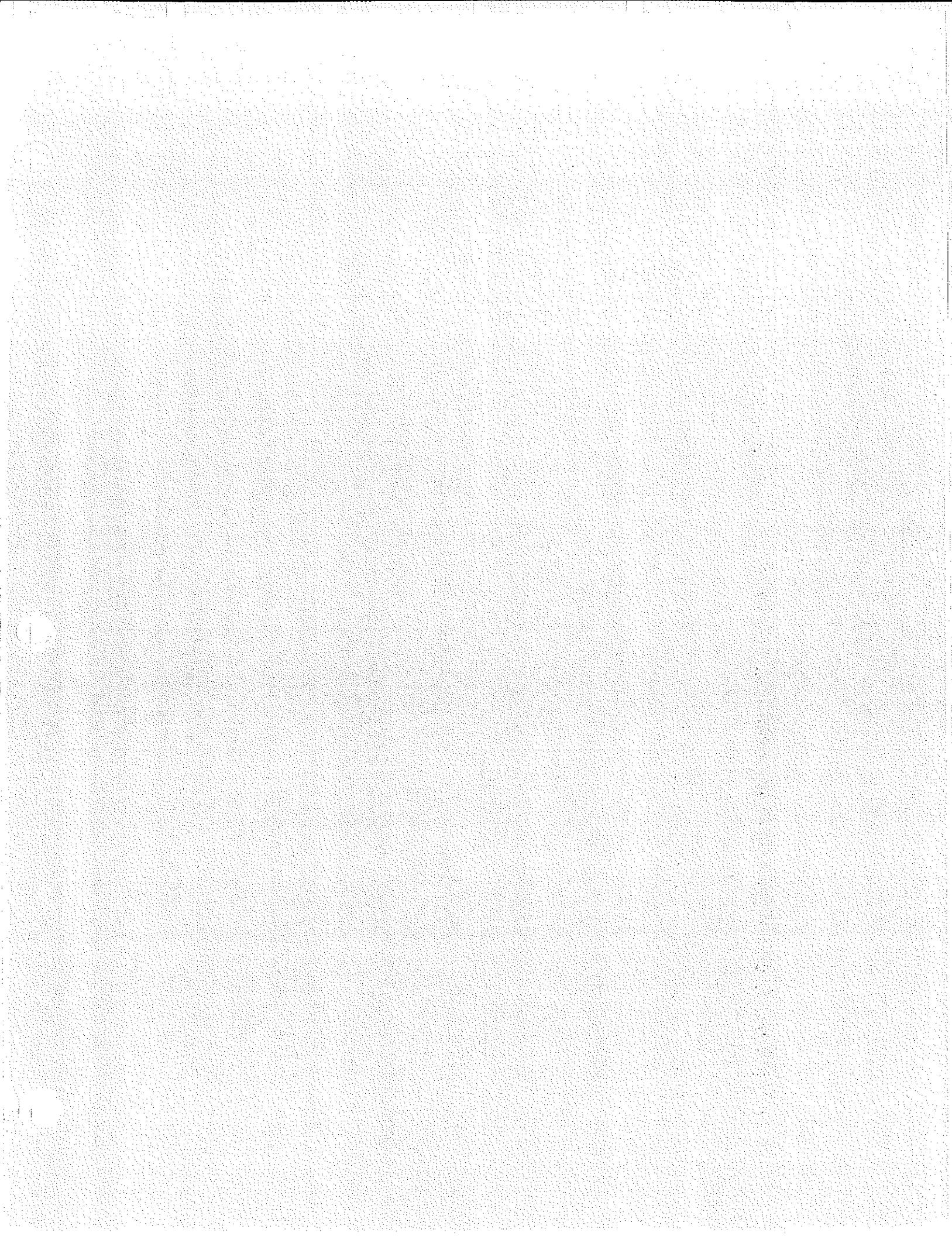
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This guide is intended to supplement instructor-led training. This guide contains the following for each exercise or demonstration:

- Overview
- Process and/or steps
- Questions and answers

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Notes:

1 – Introduction

1.1 – Your Role in Software Project Management

Software can be a small element in a large project or a large element in a small project. Either way, software is a key component of most projects today.

Think about a software development project in which you have recently been involved. Consider the following:

- Was the project scope understood?
- Were the business requirements adequately defined?
- How was performance tracked?
- Was the project adequately staffed?
- Was the project delivered on time?

Record your answers in the space provided



Describe the software development aspect of the project _____



Describe your role on the project _____



Looking back, what three things would you have done differently on the project if you had the opportunity _____

- Better communication with customer to define requirements
- + Reusability of code
- Staffing and schedule slippage to fit

Notes:



Summarize the top three challenges for software project management in your organization today. Identify how you are directly affected by these challenges _____

Notes:

2 – Context and Climate

2.1 – Making the Case for the Project

You recently accepted a project manager position with a growing company, **MyMoney.com**. MyMoney is dedicated to be the first-to-market with premier web-based personal finance applications. Your first assignment is to manage the development of a cutting-edge personal finance application for the web. The application, called **Quicker**, will be sold on a subscription/usage billing basis. The product is scheduled to begin beta test in 6 months, and to be customer-ready in 9 months.

The product design will be based on a popular current generation PC-based product and enhanced for use on the world wide web. This application will enable users to manage their personal financial data from any computer enabled with a web browser.

This will be the first product that MyMoney has sold on a subscription basis. Several national banks have expressed interest in partnering with MyMoney in this technology and offering the application as a service to their customers. Ultimately, the application would be expanded to support multi-currency and international markets.

MyMoney owns a majority interest in **WireFree**, a leader in wireless technology products. Within the first year of product launch, the Marketing is pushing to further enhance the product functionality to offer for use with wireless handheld devices and cellular phones. Marketing would like to demo the enhanced version, aka **Quickest**, at the national wireless service provider trade show in 6 months.

MyMoney is in the process of restructuring for an upcoming public offering. Due to the restructuring, you have lost some key members of the development team in recent weeks. Top executives are conducting a review of projects scheduled to begin development. This morning the senior VP approached you and requested that you present the business case for the **Quicker** development project (no pun intended) to the executive team. He added, "...and don't worry about resources for your project – we have at least a dozen summer interns coming in that are chomping at the bits for training in this technology."

Work with your team to prepare a 5 minute presentation to executive management.

Notes:



Tip

Feel free to make additional assumptions about the product and business environment in order to "make your case". Just be sure to write down all of your assumptions.

Record your answers in the space provided

✍ List 5 key bullet points that you would emphasize to management when presenting the business case for this project _____

✍ List the potential customer (groups) of this project _____

✍ Write a brief statement of the overall goal of the project _____

✍ List the deliverables that you will require for this project _____

Notes:



List some of the potential risks _____

Notes:

Notes:

3 – Software Project Phases

3.1 – Your Role in the Software Lifecycle

In this section you had the opportunity to get a better understanding of the software lifecycle. As you prepare to use this knowledge, reflect on the objectives of each phase of the lifecycle. For each phase, record the following:

- Team Factors – what do you think the “climate” of the team is typically like during this phase?
- Key Deliverables – what are the primary products and documents to be delivered in this phase?
- Opportunities – as a project manager, what can you do to avoid common mistakes made during this phase?
- Challenges – are there particular risks that are unique to this phase of the project?

Record your answers in the chart provided on the following page

Table 1. Project Management throughout the Software Lifecycle

Phase	Team Factors	Key Deliverables	Opportunities		Challenges	
			Opportunities	Challenges	Opportunities	Challenges
Requirements						
Design						
Development						
Testing						
Delivery						

Notes:

4 – Project Planning

4.1 – Developing a Plan

Congratulations...you've made significant progress in kicking off the **Quicker** project. It is now time to create an effective project plan that can be used as a roadmap for the project. Think about past project plans that you have worked with or developed. Use the Software Development Plan in the Appendix as an example and then work with your group to:

- List 5 items that you feel would be most effective in your **Quicker** plan (there will probably be more, but choose at least five)
- Of the 5 items that you chose, prepare an outline of two of the items and be prepared to share with the class
- Prepare a high-level schedule that identifies tasks, milestones, resources and dependencies
- Based on past experience, identify any aspects of the project plan that were not as useful, i.e. they seemed to create more maintenance than the benefit they added

**Tip**

Former President Eisenhower said, "The plan is nothing. The planning is everything." Remember to be flexible. The Software Development Plan will become a tool to facilitate communicate amongst the team. Re-planning is an ongoing part of the process.

Record your answers in the space provided



List 5 sections to include in your plan _____

Notes:



Outline Section 1:



Outline Section 2:



Schedule (use the space provided on the following page)



"High maintenance" plan items (optional)

Notes:**4.2 – Estimating: Buy or Build**

Bob Jackson is **SpaceTravel, Inc.**'s new program director for the upgrade of the Ground Support Equipment (GSE) test suite. The GSE suite is used to test completed vehicles before they are packaged for final delivery and to provide final vehicle acceptance prior to launch.

Part of his project requires a complete re-write of the flight simulation software module for the GSE. The team has completed the general software requirements, and now Bob must determine whether to have this software developed in-house or by an experienced contractor.

Bob and his team have established the following project parameters based on their general requirements:

- Complexity: This is a high complexity project
- Estimated size: 20,000 lines of code (LOC)
- Drop Dead Delivery: No later than 12 months from contract award
- Coding Language: C++

The requirements specification and the project parameters were provided to both the in-house team and the contractor team to develop a project estimate and bid package.

After receiving the two bids, Bob prepared the bid summary shown in Table 1:

Table 1. Bid Summary

	In-House Bid	Contractor Bid
Cost (\$ U.S.)	\$3,120,000	\$2,250,000
Schedule (in Months)	10	4
Effort (in Man-hours)	26000	15000

The contractor has, in the past delivered quality software at a competitive price. However, his in-house staff is on the record to the program office that, based on the requirement specification, the project is significantly more complex than it appears.

Notes:

Bob now has a problem. Is his contractor bid too optimistic or is the in-house development staff trying to keep the job within the company? Given the historical project data shown in Table 2, Bob is asking you to help him make a decision by preparing your own estimate.

Table 2. Recent Software Project Historical Performance Data

Project	Type	Language	Complexity Rating	Estimated Effort (man-hrs)	Actual Effort (man-hrs)	Estimated Costs	Actual Costs	Estimated Schedule (Days)	Actual Schedule (Days)	Estimated Size (LOC)	Actual Size (LOC)
SAT 1	Real-time embedded system/avionics	C++	Low	5,200	6,000	\$624,000	\$720,000	130	135	4,5	10,000
SAT 2	Real-time embedded system/avionics	C++	Medium	900	950	\$108,000	\$114,000	80	2.67	80	2.7
GSE 1	Scientific	C++	Low	4,000	3,920	\$480,000	\$470,400	160	5.33	161	5.4
GSE 2	Scientific	C++	High	8,600	5,200	\$1,032,000	\$624,000	200	6.67	110	3.7
FMS 1	Business System	Visual Basic	High	17,200	16,000	\$2,064,000	\$1,920,000	300	10.00	289	9.6
FMS 2	Business System	Visual Basic	Medium	1,000	1,250	\$120,000	\$150,000	90	3.00	89	3.0

Notes:

You and Bob have made the following assumptions to help simplify your estimating effort:

- The standard estimating rate for your company is \$120/hour
- A high complexity project has a complexity rating of 1.00, a medium complexity project has a rating of 0.75 and a low complexity project has a rating of 0.50
- An average development team size consists of 10 staff members
- On average, 30% of the project team's time is spent on non-project related activities such as training, vacations, holidays, etc.

Provide Bob with an estimate based on the historical data and the assumptions. In addition, provide an assessment of the accuracy/quality of the bids that your project has received.

**Tip**

Prepare an estimate by analogy using the other C++ projects. The metric that you want to establish is man-hours per line of code (man hours/SLOC).

Record your answers in the space provided



Calculate the complexity adjustments (known as R-factors in a parametric estimate)

R-Factors

	Complexity (H/M/L)	Complexity Adjustment	Actual Man-Hours	Adjusted Man-Hours
SAT1				
SAT2				
GSE1				
GSE2				

Notes:

- ✍ Derive the average man hours/SLOC estimate based on the adjusted project man-hours

Average Man-Hours/SLOC

	Adjusted Man-Hours	Actual SLOC	Man-Hours /SLOC
SAT1			
SAT2			
GSE1			
GSE2			
Average:			

- ✍ Use the average Man-Hours/SLOC to finalize the estimates:

Size (SLOC) = _____

Effort (Man-Hours) = SLOC * Man-Hours/SLOC

Cost = Man-Hours * Std Hourly Rate

Schedule (assume an average staff size of 10)

Conservative estimate:

Aggressive estimate: ("full bore"):

Notes:

Complete the Final Bid Analysis table based on your calculations.
Compare our bid to the contractor and in-house bids.

Final Bid Analysis

	In-House Bid	Contractor Bid	Our Bid
Cost (\$ U.S.)	\$3,120,000	\$2,250,000	\$_____
Schedule (in Months)	10	4	_____
Effort (in Man-hours)	26000	15000	_____

Based on your analysis:



What questions would you ask the contractor for clarification about their bid? _____



What questions would you ask the in-house development team for clarification about their bid? _____

Notes:

For an additional sanity check, you and Bob calibrate an estimating tool with the same historical project data and assumptions. The tool-based estimate results were:

- Effort = 77 Man-Months (13,346 Man-Hours)
- Schedule = 6.5 Months
- Peak Staff = 17.9 FTEs
- Cost \$1,405,896



Explain your decision to buy or build _____

Notes:

Notes:

5 – Software Development Lifecycle

5.1 – Selecting a Software Development Lifecycle

Part 1: In order to meet the aggressive project schedule and quality requirements for **Quicker**, the IT director met with you this morning to finalize the lifecycle that will be used for the software development. Now you need to meet with the project customers to explain the benefits of the chosen lifecycle.

Work with your team to identify the advantages of the selected life cycle.

Record your answers in the space provided



Which lifecycle did you choose? How will you explain this choice to the customers? _____

I want to work closely with the customer. As a result, a incremental/spiral approach closer to better develop the product based on requirements fed to the team by the customer. The customer will receive multiple builds with new features integrated into each new build. In the end, the customer will receive a build that they have had the benefit of working with all along the development lifecycle. throughout

Notes:

Part 2: After a successful presentation to senior management this morning for **Quicker**, you went out for a "team-building" lunch. At the restaurant you ran into Melissa Hatcher, an old friend from college. She is now the VP of New Product Development for MTR Software. You thought you had a challenge until you heard her concerns about her new project.

She and her most experienced application development team are finishing a Statement of Work for a new web-based records management application for Dewie, Cheetum and Howe (DC&H), a prominent local law firm. While she is very confident in her team's capability, MTR Software hasn't yet provided products for the legal profession. The project could be considered risky, especially if DC&H is not delighted with the product. On the other hand, success opens up a new product line.

Her project manager, Bill Ledet, is not only an experienced software project manager, he has more than 10 years of document management and records management application development experience for engineering documentation applications. Bill and his team are ready for a new project. Several of his project staff also have document management experience. However, none of the team has legal records management experience. All of the project staff are experienced web-based/n-tier application developers. The project manager has worked with the same team for more than three years.

Bill and Melissa have held several consultation meetings with DC&H's technical support leader. These meetings have revealed that DC&H is only just starting to automate their records management process and do not have a clear vision of how they would process their documents and records with a records management software system. What was clear to Bill was that the legal requirements for a records management system in a law firm were much more complex than his team's engineering document management experience. The system would be much more than a document library system with superior search, view and print capabilities. It would also have to include a records archive that would have to meet the legal requirements for an electronic records archive with some records having to be kept for the life of the corporation. Bill and Melissa also realized that DC&H would also want to convert their legacy hard copy files into electronic records as part of a follow on project.

Notes:

DC&H stated that because they recognized that their understanding of their business requirements was low, they were flexible as to when the system would be delivered, but the Managing Partners have an expectation of delivery within 18 months of statement of work approval. Bill believed that the system could be delivered within this constraint due to his team's experience with web-based document and records management systems for similar document volumes, and because his team was experienced with the core technology needed to build the system.

Melissa asks you to give Bill a call and help him select a software development lifecycle model for the project.



Tip

Use the Software Development Life Cycle (SDLC) selection matrix to help Bill decide. Be prepared to defend your selection!

Record your answers in the space provided



Which lifecycle did you choose? Explain. _____

A series of six horizontal lines, each containing a dense pattern of small black dots, arranged vertically. The lines are evenly spaced and extend across the width of the page.

Notes:**5.2 – Writing the Requirements**

Back to work! One of your first responsibilities for **Quicker** is to work with the team to define requirements. The initial task is to document the requirements for the electronic checkbook function.

These requirements will serve as a deliverable to either an in-house development team or a 3rd party software developer. The requirements will provide the foundation upon which the software development process is based.

**Tip**

Think about the types of reports that you want to produce with this software. This can help in identifying requirements and the underlying functionality necessary to support them.

For this exercise, it is important to write requirements that would contain sufficient detail for the development team to design and code an application. Ultimately, these requirements should be verifiable via testing. It is not as important to produce a complete set of requirements for this exercise.

Record the requirements below

1. The checkbook function CSU shall be written in the JavaTM programming language.
2. The checkbook function CSU shall be capable of displaying up-to-date balance information.
3. The checkbook function CSU shall be capable of displaying POS purchases by date.
4. The checkbook function CSU shall be capable of printing checks.
5. The checkbook function CSU shall be capable of displaying ~~printed~~ checks written offline ^{after} processing ~~is~~ is complete.
- 6.

6. The checkbook function CSU shall be capable of ~~check~~ ~~with~~ creating a check online. **Notes:**
7. The checkbook function CSU shall be capable of handling erroneous data in fields of the checkbook.
8. The checkbook CSU shall be capable of voiding a check if the balance ~~be~~ would be less than ~~the~~ ^{the predefined overdraft limit} after processing.
9. The checkbook CSU shall have the functionality of incrementing ~~the current~~ ^{the current} check number after by one for every check written.

Notes:

5.3 – Writing the Test Plan

Write a test plan for the requirements you developed for **Quickest** (the web-based electronic checkbook). Be sure to include the resources that are necessary to perform testing. In addition, your individual tests should identify which requirements are being tested.

For this exercise, it is not as important to provide a complete test plan as it is to generate tests that demonstrate that the software functions correctly according to the requirements.

Record the test plan below

Notes:

Notes: