CECS 491A

Risk analysis

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Purpose

In this document our team has evaluated our project to identify issues, vulnerabilities and the consequences these vulnerabilities have during and after developing the system. The purpose of this risk analysis is to foreshadow any point of failures so the team can mitigate the risk. After we have identified any potential risk we will carry our an analysis to quantify the probability and impact each risk has. Then we will come up with a strategy or plan to handle and respond after a the system has undergone one of our identified risk.

Summary

This document is split in three sections identify, analysis, and mitigation. In the identify section we start off by listing the various potential problems and the causes of issues within our project. After describing them, we display fishbone diagrams to give a visual representation of the different causes and the effects problems have in our project. In our document we focus on four main categories of effects which are scope, quality, time, and cost. Scope deals with how much work gets completed. Quality is how good or bad the work is. Time is a crucial limited resource that we must use wisely. Cost is how much we are willing to spend out of our own pockets. Our analysis start off by describing how each problems affects our project. Then we display influence diagrams that shows the causes of problems in our project, the risk associated with that problem, and the action to take to resolve that problem. Last we describe the mitigation of each problem with decision trees. The first square in the decision tree is the problem, then it keeps branching out and makes squares that represent the mitigation for that problem. Each time one square branches out to another a probability is associated that represents how likely we are to use that specific approach. Each decision also has an expected cost to help us know what decision cost more or will take up more time. Each decision expected cost and probability is carefully calculated and described. Onces a final decision is made the effect of the decision is evaluated. The four main effects decisions have on our project are scope, quality, time, and cost. Each decision has pros and cons to it, which is why we use the probability and expected cost to help us decide.

Identify

Section A) Possible Integration Issues

1. Integrating our different communication capabilities which includes text messages, video chat, audio capabilities. Each of these capabilities have a different protocol or software need to function property. If integration fails then we will need to pick which communicate capability to use.
2. Integration of our American Sign Language(ASL) software with our communication software. If our ASL does integrate well with our communication software, then we will be forced to choose which capabilities to use and delete others.
3. Integration of our ASL software with the data set we chose for our training model. If our training model does integrate with our ASL software the user will not be able to communicate using ASL.
4. If our screen reader software does not interact properly with our message software then the user will not be able to receive the output of the text
5. If our voice interpreter/recognizer does not interact with our message software properly then the user will not be able to communicate with the other user by talking to the mic of our computer.

Section B) Implement Risks

1. If the accuracy of the ASL translation software is not proficient
2. If the screen reader software does not interpret the string correctly
3. If the audio translation software is not proficient

Section C) Application Risks

1. If our application can't access the database
2. If our application can't translate sign language
3. If our application can't connect to the server.
4. If our application can't turn English speech to text

Section D) System Risks

1. If our server shuts down
2. If a client's machine shuts down during a video chat
3. If our database runs out of space or gets corrupted

Section E) Non-Completed Work

1. If our ASL software is not complete then the user will not be able to communicate using hand gestures.
2. If our video chat capabilities is not completed then the user will not be able to see each other while they communicating.
3. If our message chat capability is not completed then the user will not be able to communicate through text.
4. If our screen reader software is not completed then the user will not be able to receive the output in an audio format.
5. If our voice interpreter/recognizer is not completed the the user will not be able to communicate by talking.

Section F） Security Related

1. If our server is compromised
2. If our database is breached

Section G） User causing any error

1. If the user spams the message chat then he\she can overload the server, which will lead to a denial of service.

Section H） Schedule/Time

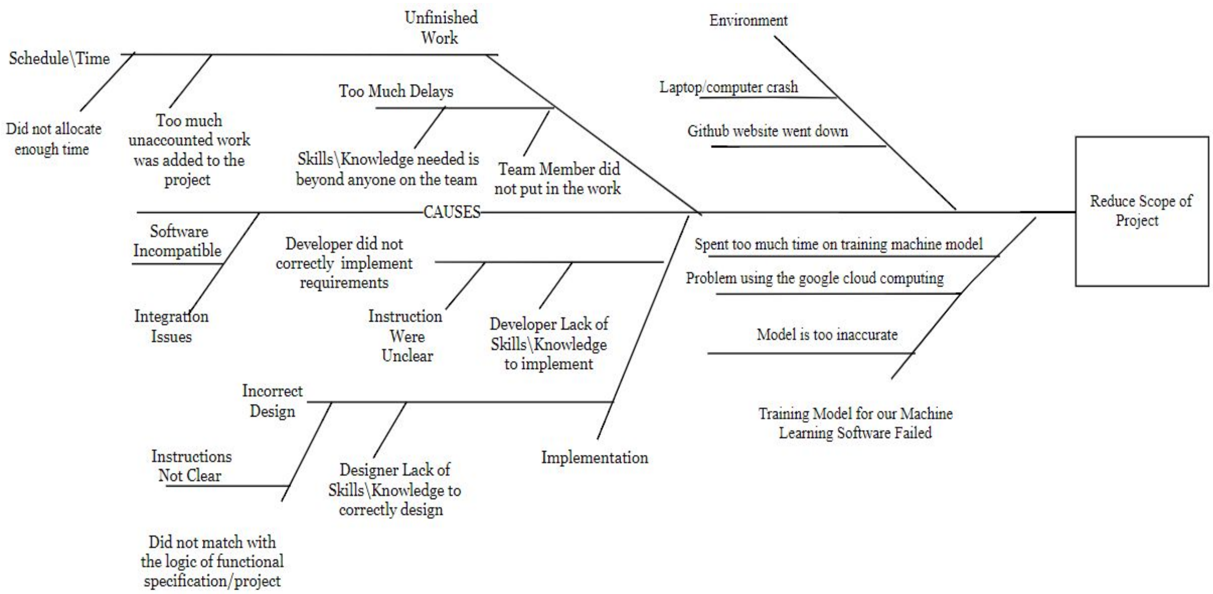
If we fall behind on any of our capabilities due dates, then that will delay the capabilities procedening the current capability. This will can result in the incompletion of a capability that is essential to our project. Falling behind schedule can also impact the quality of the component due to our poor design or implementation. Falling behind schedule can result in the completion of our component but cause the incompletion of testing.

Section I） Non-functional System Failure

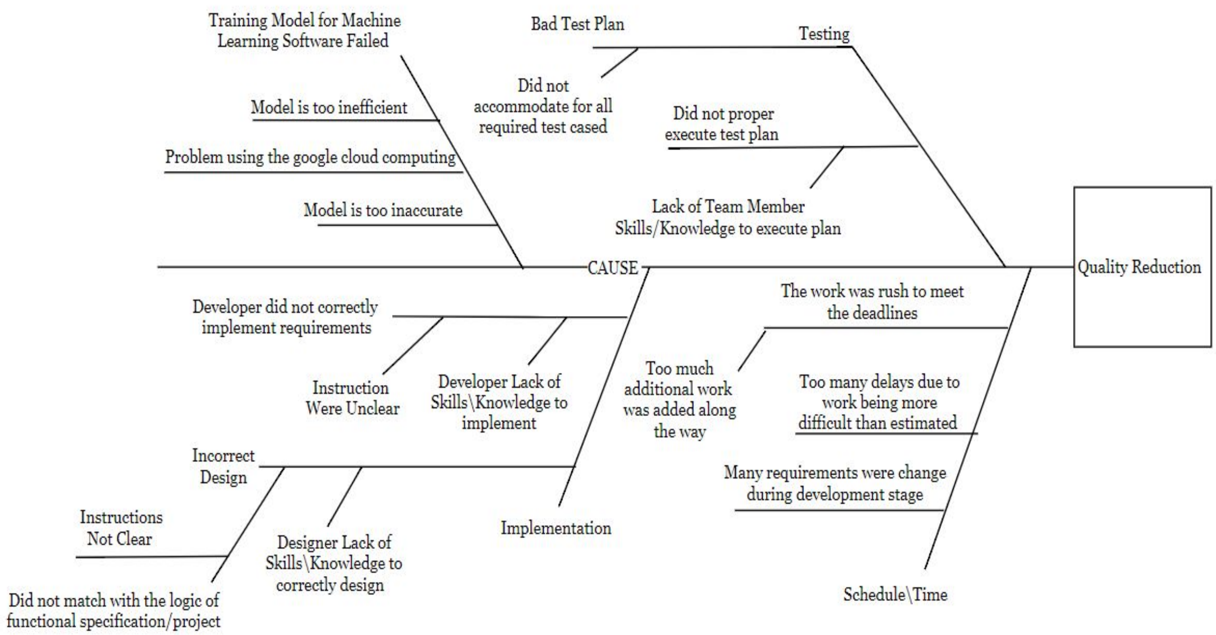
Our nonfunctional system failure includes any hardware failure such as camera, cpu, ram, and graphics card. If the operating system the user can have trouble accessing or uploading our program. If the camera fails then the user will not be able to do a video chat. If the CPU contains any failure then the computer will not be to execute any programs, that includes our program. If RAM exhibits any failure then we can expect our program to exhibit delays in performance. Our Nonfunctional System failure also considers internet access which is necessary. If the graphic card exhibits any failure then we can expect our program to exhibit delays in performance.

FISHBONE DIAGRAM

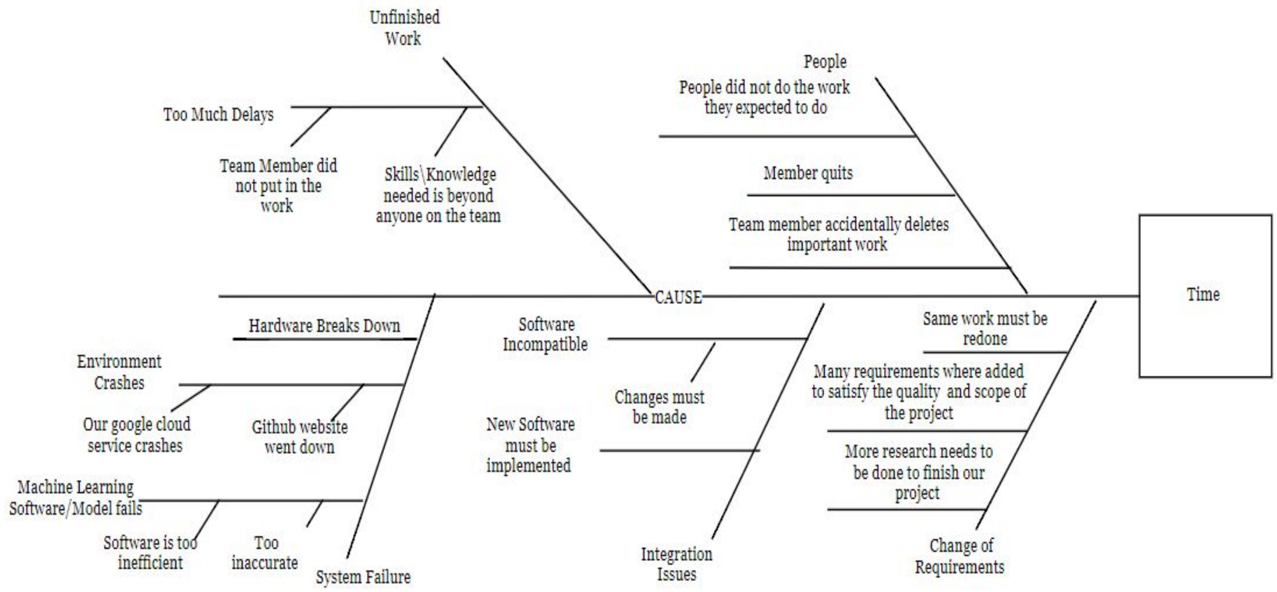
Reduce Scope of Project:



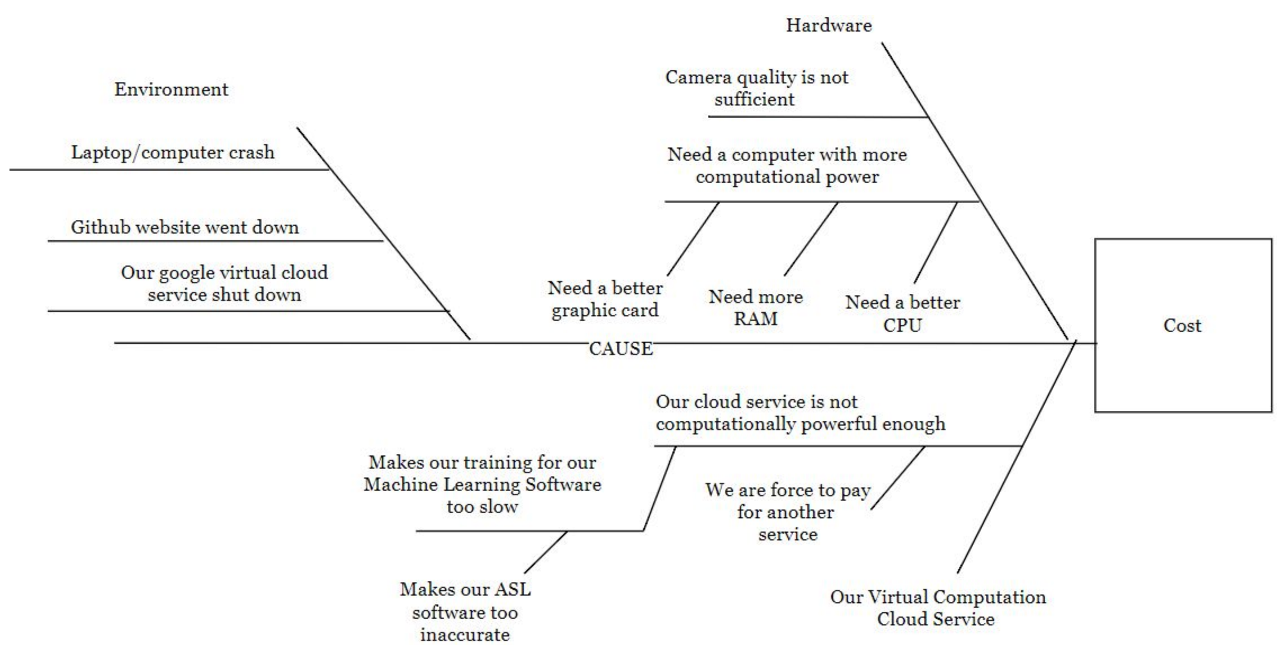
Quality Reduction:



Time Effect:



Cost Effect:



Analysis

Possible Integration Issues

If our program has any integration issues regarding section(A.1) then users will not be able to communicate with each other in the intended way. They will either have some or none of the options specified in section(A.1) which include text, video, audio. All these capabilities are crucially important to our project and user experience. If our section(A.1) text system fails users will not be about to communicate through text. If video fails the users will not be able to see each other. If the audio system fails the users will not be able to hear each other. All these issues will hurt the overall quality of the project, making an undesirable experience for the user. If we are to fix these issues then we will need to increase our budget. The increase in budget is necessary for more man hours to fix and complete the work. Assuming that each component works great on its own, we would need an additional 3 days time worth of work to fix this since we allocated a day for each component since this section includes 3 components. This issues can potentially affect the entire project which means we can ignore or carry on to other tasks until this is finished.

If we have any integration issues with section(A.2 - A.3) then our project with not have the capability to communicate using ASL. This capability is essentially the accomplishment and purpose our project was meant to fix. To fix this issue we would need an additional 10 hours from each member, each member of the group would spend their hours looking at a different area which are design, implementation, and testing.

Any integration issues included in section(A.4) will affect the user ability to receive the output in an audio format. This is not a big issue for the user unless they are blind. This capability is not a big priority in our project, so it does not affect the rest of the project if this component never gets integrated. To fix this issue we would need an additional 10 hours from each member, each member of the group would spend their hours looking at a different area which are design, implementation, and testing.

Any integration issues included in section(A.4) will affect the user ability to input their message using the microphone. This capability is meant to make it easy for the user to communicate like in a real life face to face conversation. This is not a big issue for the user unless they are blind. This capability is not a big priority in our project, so it does not affect the rest of the project if this component never gets integrated. To fix this issue we would need an additional 10 hours from each member, each member of the group would spend their hours looking at a different area which are design, implementation, and testing.

Application Issues

No software first launch is perfect. Bug fixes and updating version are pushing out regularly aiming to increase the user's experience. From many aspect of failure, there are failure risk in the application itself. First risk that we recognized is the application can' access the database (C.1) or the server (C.3). The database is embedded on the server instance, not able to access one will propagate to the other. The problem very likely due to poor connection or some hardware incompatible that not allow the software to work properly. To the developer, hardware incompatibility will cost a lot because it required a restructure to the backend codes to work with that particular hardware. The user will likely abandon the software if they can't even use it for regular video chat. Another application risk is ASL recognition software can't classify the images feeding from the camera (C.2). There are many reason for this failure including brightness, webcam quality, feed in gesture does not exist in the trained model, wall color, etc. This failure give a very important back to the team that the model required more computing hours and the database needed to be more diverse. Without implementing the recognition software right, it will cost the team a lot more time to increase the ASL gestures database and huge expense for cloud computing at least 100 hours+. The last risk we recognized is the software voice recognition doesn't work. Though voice recognition get affect less by the external source, there are a very important external source that will affect the software, that is background noise. With too loud of the noise, it completely change the frequency of the audio input file hence will give a wrong output text. Since this feature scope aren't as big as our ASL scope, the cost get minimize but definitely pushing our project schedule at least 2 weeks for proper implementation and testing.

System Risks

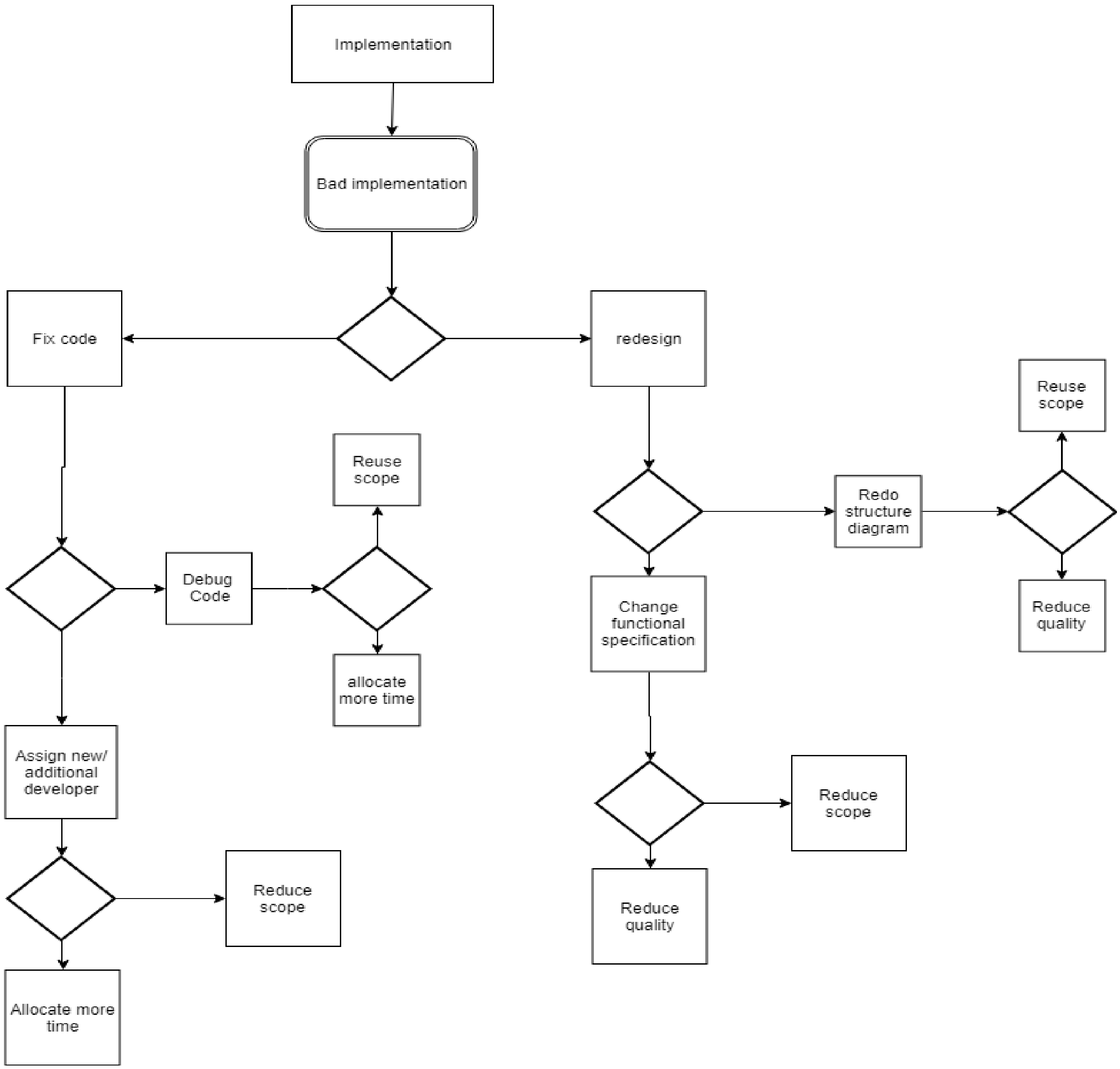
Maintaining our server traffic and database for users' profiles is a high priority after we launch the application into the market. If the server is overloaded and shuts down(D.1), it will affect the entire system and propagate to every single user. Consequently, users will not able to use any features from the software. This will lead to negative user experiences and will potentially cause a loss in profit for both us and the user if the software becomes commercialised. Providing a sizable and long lasting database is a must if we want to create the best user experience possible. The database is used to store every single user's information, such as: email, username, password, contact information, and conversation log files. If the database becomes corrupt (D.3), the software will not work according to the logic of our state diagram; the software will log everyone in as guest users if they can't verify the user's information. Also if the database is full (D.3), it will affect current users and potentially new users. Current users won't able to make any changes and their conversations will not be saved to log files. The new users won't be able to register an account since there will no longer be any space in the database for more accounts. The last problem is this can cause an interruption in the user's computer and result in a shut down or restart (D.2). We will count it as interruption in connection and whatever change the user makes last will be the last point of their entry in the database.

Non-completed work

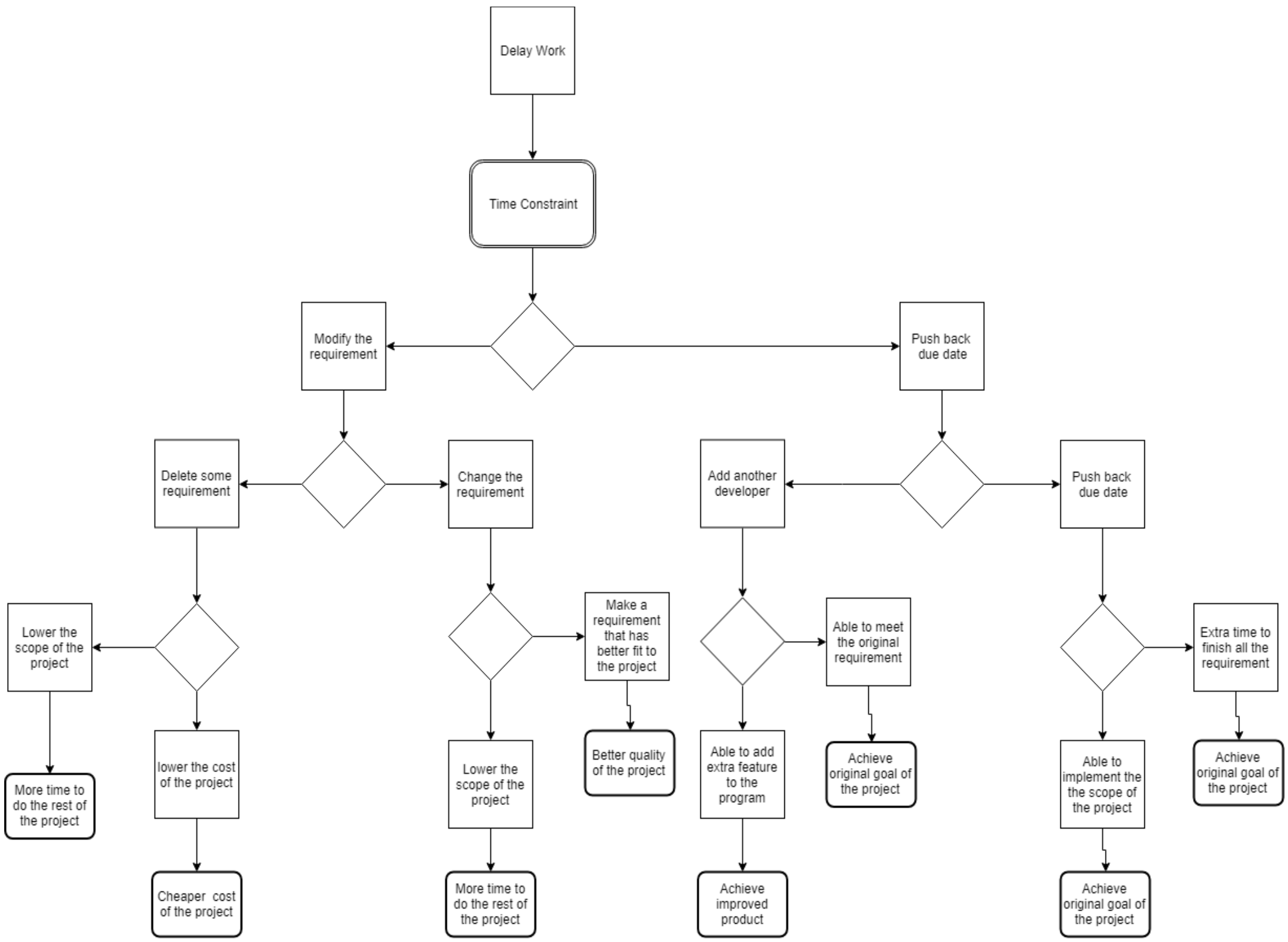
The developers greatest desire is to implement every goals or functionalities of the project, but there are times that all the goals will not be completely finish by the project deadline. In this section, we will look into how non-completed functionalities affect the whole team as well as the software. The potential four non-completed functionalities are: ASL software, video chat capabilities, message chat, and voice interpreter/recognizer. First, video chat capabilities is the highest in priority to have the function complete (E.2). This function is the base of our project as a communication software. Without this function, the project deems to be fail hence the fund use to pay for labor and hardware is completely wasted. This also affect the credibility of the developers due to their lack of skill to accomplish the basic function of the software. Second highest risk is our ASL recognition software (E.1). Beside able to communicate with other users, ASL software is the market point of this project. Not finishing the software will cost the team majority of the budget, which will include the most expensive expense Google Cloud computing for machine learning model, and most schedule consuming task that to find the suitable data to manually label. Without this feature working, we will have to sacrifice our message method and speech recognition. We will needs to push our schedule as far as needed to complete this feature. Not able to have a message chat aren't as important as able to video chat and ASL feature(E.3). However, this function set-up the message connection between server and the client. Since ASL recognition software output will be text, the message function will help increase the efficiency of the software in term of reusability. ASL recognition and speech recognition functions will send the output the same method as message function. In complete of message function will not cost us a lot because it is viewed as an add-on function in the project. The same cost applied for voice interpreter/recognizer function (E.5). The main scope of the project is to create ASL communication software that mainly focus on machine learning and analyzing image. Working with sound file and analyzing sound frequency to recognize into a work are out of the team current field. This function is setted as an add-on that we really preferred to have so it will only affect the fund that will be spend on hardware and reduced the uniqueness of the software comparing to the market.

Influence Diagram

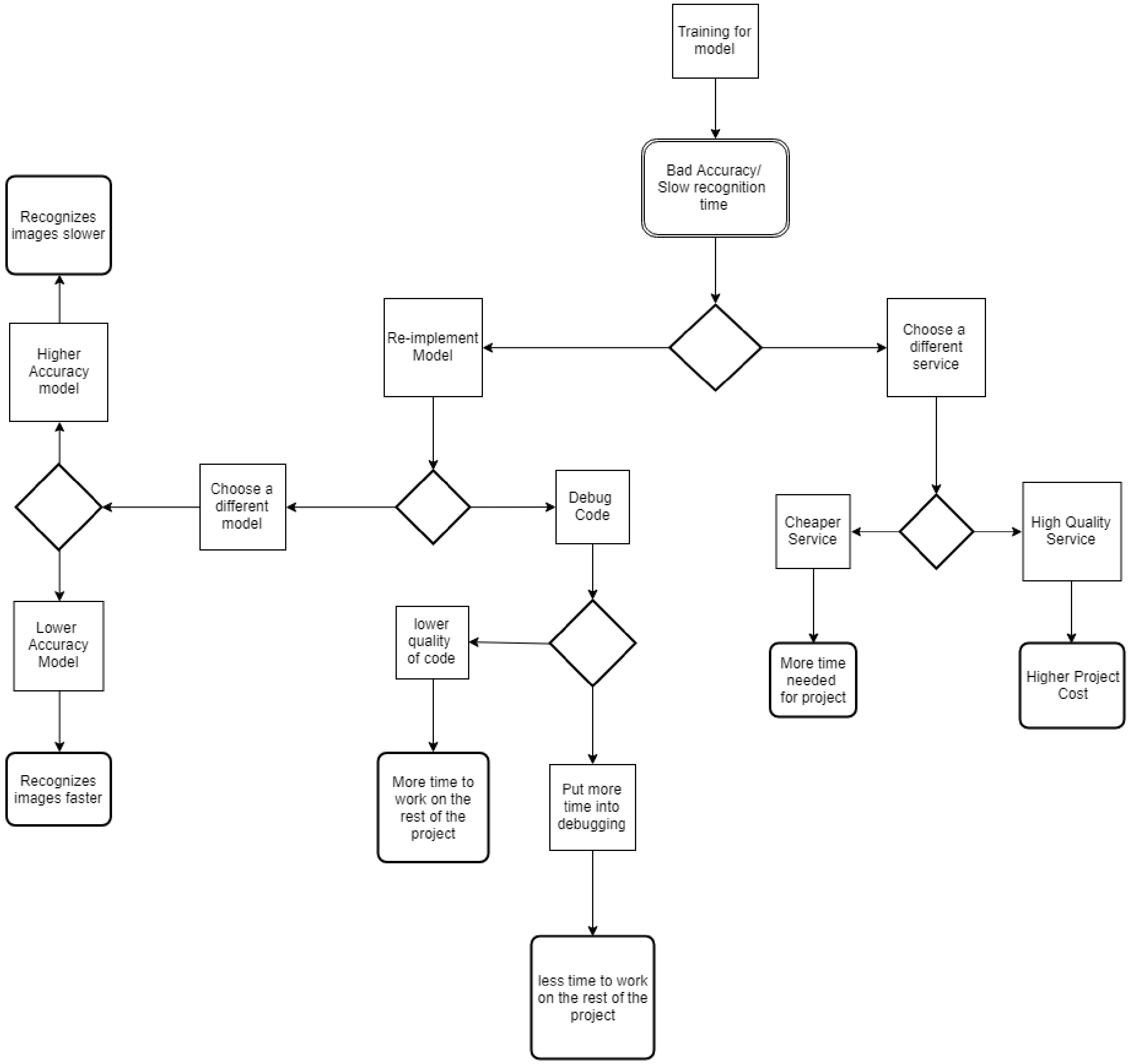
Bad Implementation:



<u>Delay of Work in Schedule:</u>



Training the machine learning model:



Mitigation

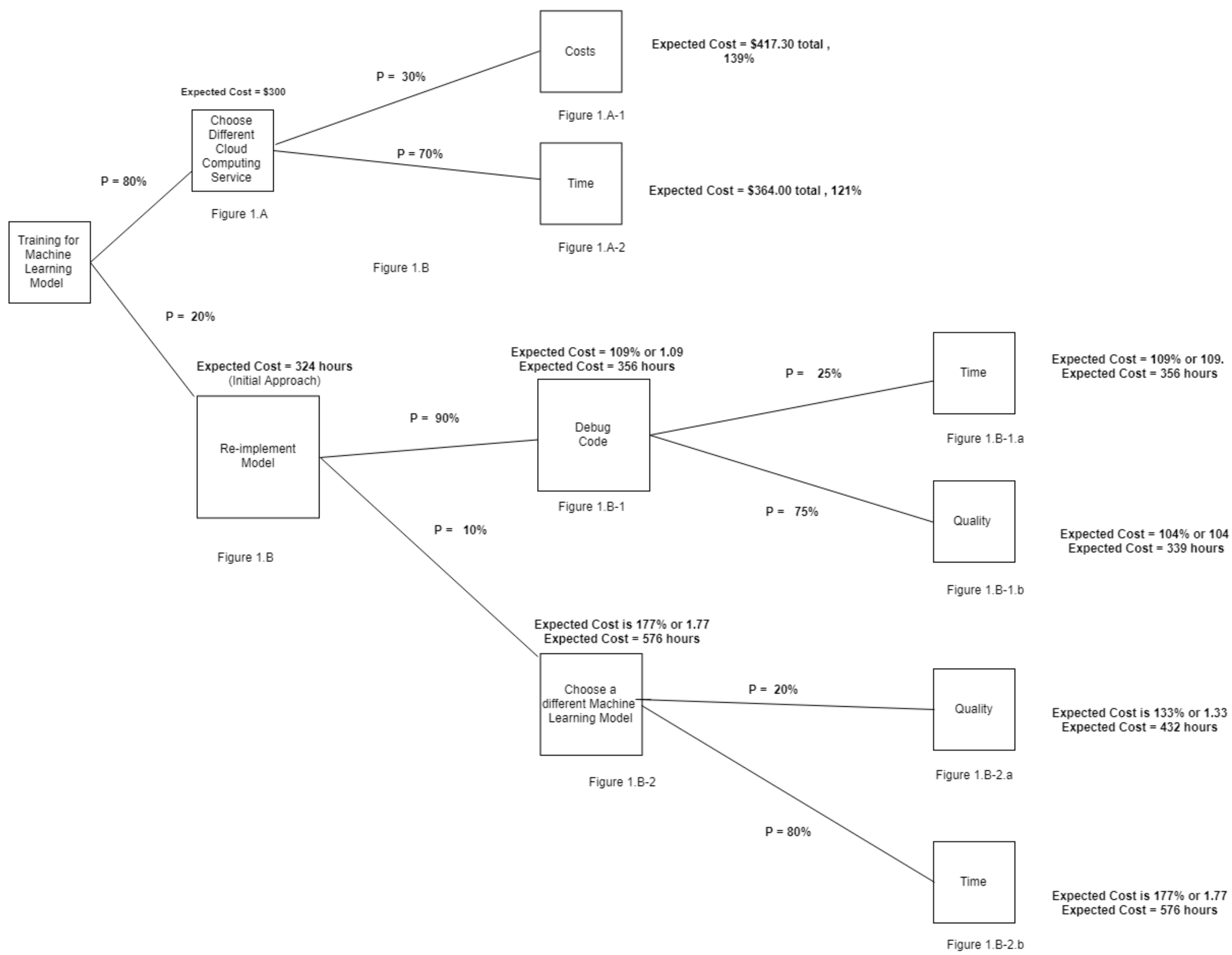


Figure 1

<u>Figure 1.A: Choose a different Service</u>

This approach to fixing our machine learning model is to choose a different service. What we mean by service is our virtual computer instance hosted by a company. We use there service because it takes a lot of computational power to train our machine learning model, which is why we use a cloud service with the necessary resources. This approach of choosing a new cloud computing has an 80% chance because even though more spending is involve, this approach saves us a lot of time compare to picking a new model.

Initial Cost
We plan our training our model for 200 hours. The service we picked is NVIDIA Tesla P100 Virtual Workstation. This service cost $1.50 an hour.

Expected Cost = $300
Expected Cost = hours x cost
Hours = 200
Cost = 1.50/hr
Expected Cost = $200 x $1.50/hr = $300

Figure 1.A-1: Cost

If we go with this approach then we are adding another virtual cloud computing service that will be inexpensive but will cost. However this approach will take us more time since the resource are not as computationally strong. This approach has 30% chance because this service is not as efficient and time might be an issue.

Initial Cost
We plan our training our model for 200 hours. The service we picked is NVIDIA Tesla P100 Virtual Workstation. This service cost $1.50 an hour.

Additional Cost
If we were to choose another reliable and fast service from Microsoft azure for 100 hours at $0.64/hr, then it will cost us an additional $64.00,which would a total of $364.00.

Expected Cost = $364.00 total , 121%
Expected Cost = Initial Cost + Additional Cost
Initial Cost = $300
Additional Cost = Time Needed X Service_Cost_Per_Hour
Time Needed = 100 hours
Service_Cost_Per_Hour = $0.64/hr
Additional COst = 100 hours X $0.173/hours = $64.00
Expected Cost = $300 + $64.00 = $364.30
Expected increase cost = (Total Cost/Initial Cost)
Expected Cost = ($364.00/$300) = 1.21 or 121%.

Figure 1.A-2: Time

If we go with this approach then we are adding another virtual cloud computing service that will be expensive but will save us time since it will have better computational resources. This approach has 70% chance because we care more about the time we are saving than the money we are wasting.

Initial Cost
We plan our training our model for 200 hours. The service we picked is NVIDIA Tesla P100 Virtual Workstation. This service cost $1.50 an hour.

Additional Cost
If we were to choose another reliable and fast service from Microsoft azure for 100 hours at $1.173/hr, then it will cost us an additional $117.30,which would a total of $417.30.

Expected Cost = $417.30 total , 139%
Expected Cost = Initial Cost + Additional Cost
Initial Cost = $300
Additional Cost = Time Needed X Service_Cost_Per_Hour
Time Needed = 100 hours
Service_Cost_Per_Hour = $1.173/hr
Additional COst = 100 hours X $1.173/hours = $117.30
Expected Cost = $300 + $117.30 = $417.30
Expected increase cost = (Total Cost/Initial Cost)
Expected Cost = ($417.30/$300) = 1.39 or 139%

Figure 1.B: Re-implement Model

If our training model for machine learning fails due to inaccuracy or performance, then we have to re-implement it. The reason why it has a small probability of 20% is because this approach is very time expensive.

Expected Cost = 252 hours
Initial cost of the Model is component 3 of our schedule which we allocated from January 20 to March 25, 2019 , which is about 9 weeks. Each week we allocate 9 hours of outside work per person, and we have 4 member so in total we have 324 hours of outside work for this component in our project. Outside work are work hours we contribute to our project outside of the classroom.

Total = Time X People
Time = 9 weeks x 9 hours/ week = 81 hours

People = 4
Total = 81 hours/person X 4 people = 324 hours

Figure 1.B-1: Debug Code

If we decide to re-implement the model one approach is to fix what we already have by debugging. This approach has a 90% chance since is it less time expensive.

Initial Cost
Initial cost of the entire Model is component 3 of our schedule which we allocated from January 20 to March 25, 2019 , which is about 9 weeks. Each week we allocate 9 hours of outside work per person, and we have 4 member so in total we have 324 hours of outside work for this component in our project. Outside work are work hours we contribute to our project outside of the classroom.

Additional Cost
We estimate that our over all time needed for debugging and re-testing will be 1 week, with all four members contributing.

Initial_Time = Time X People
Time = 9 weeks x 9 hours/ week = 81 hours
People = 4
Initial_Time = 81 hours/person X 4 people = 324 hours

Additional_Time = Time X People
Time = 1 weeks x 9 hours/ week = 9 hours
People = 4
Additional_Time = 9 hours/person X 4 people = 32 hours

Expected Cost is 109% or 1.09
Total_Time = Intial_Time + Additional_Time
Total_Time = 324 hours + 32 hours = 356 hours
Expected Cost = TOtal_Time/Initial_Time
Expected Cost = 356 Hours/ 324 hours = 1.09 or 109%

Figure 1.B-1.a: Time

This approach is take if we care more about saving time and less about quality. This approach has a 25% chance of happening, to save time we cut the debugging additional time specified figure 1.B-1 in in half. The debugging process was originally estimated at 1 week according to figure 1.B-1, now it will be done in 3 days.

Initial Cost
Initial cost of the entire Model is component 3 of our schedule which we allocated from January 20 to March 25, 2019 , which is about 9 weeks. Each week we allocate 9 hours of outside work per person, and we have 4 member so in total we have 324 hours of outside work for this component in our project.Outside work are work hours we contribute to our project outside of the classroom.

Additional Cost
To save time we estimate the completion of debugging in 3 days.

Initial_Time = Time X People
Time = 9 weeks x 9 hours/ week = 81 hours
People = 4
Initial_Time = 81 hours/person X 4 people = 324 hours

Additional_Time = Time X People
Time = .42 week x 9 hours/week = 3.8 hours
People = 4
Additional_Time = 3.8hours/person X 4 people = 15 hours

Expected Cost is 109% or 1.09
Total_Time = Intial_Time + Additional_Time
Total_Time = 324 hours + 15 hours = 339 hours
Expected Cost = TOtal_Time/Initial_Time
Expected Cost = 339 Hours/ 324 hours = 1.04 or 104%

Figure 1.B-1.b: Quality

This approach is taken if we care more about the quality of our debugging and are willing to devote all the necessary time. This approach has a 75% chance of happening, because we think the quality of our machine learning model is very essential to our project. Since we care about the quality we are willing to devote the complete amount of time it is estimated to debug, which has an expected cost of 109% or 1.09 and 356 hours which was calculated in figure 1.B-1.

Initial Cost
Initial cost of the entire Model is component 3 of our schedule which we allocated from January 20 to March 25, 2019 , which is about 9 weeks. Each week we allocate 9 hours of outside work per person, and we have 4 member so in total we have 324 hours of outside work for this component in our project. Outside work are work hours we contribute to our project outside of the classroom.

Additional Cost

We estimate that our over all time needed for debugging and re-testing will be 1 week, with all four members contributing.

Initial_Time = Time X People
Time = 9 weeks x 9 hours/ week = 81 hours
People = 4
Initial_Time = 81 hours/person X 4 people = 324 hours

Additional_Time = Time X People
Time = 1 weeks x 9 hours/ week = 9 hours
People = 4
Additional_Time = 9 hours/person X 4 people = 32 hours

Expected Cost is 109% or 1.09
Total_Time = Intial_Time + Additional_Time
Total_Time = 324 hours + 32 hours = 356 hours
Expected Cost = TOtal_Time/Initial_Time
Expected Cost = 356 Hours/ 324 hours = 1.09 or 109%

Figure 1.B-2: Choose a different machine learning model

If we decide to re-implement the model then one approach is to use another model. This approach has a small probability of 10% because this approach can potentially delay and cause unfinished work.

Initial Cost

Initial cost of the entire model is component 3 of our schedule which we allocated from January 20 to March 25, 2019 , which is about 9 weeks. Each week we allocate 9 hours of outside work per person, and we have 4 member so in total we have 324 hours of outside work for this component in our project.Outside work are work hours we contribute to our project outside of the classroom.

Additional Cost

We estimated that our additional time needed if we were to choose a different model for our Machine Learning American Sign Language software will be 7 weeks, for each member. Our reason is because we will need to reimplement and test the new model our schedule for implementation and testing our original will be from Feb 3 to March 25, which is about 7 weeks.

Initial_Time = Time X People
Time = 9 weeks x 9 hours/ week = 81 hours
People = 4

Initial_Time = 81 hours/person X 4 people = 324 hours

Additional_Time = Time X People
Time = 7 weeks x 9 hours/ week = 63 hours
People = 4
Additional_Time = 63 hours/person X 4 people = 252 hours

Expected Cost is 1.77% or 1.77
Total_Time = Intial_Time + Additional_Time
Total_Time = 324 hours + 252 hours = 576 hours
Expected Cost = Intial_Time + Additional_Time/Initial_Time
Expected Cost = 576 Hours/ 324 hours = 1.77 or 177%

Figure 1.B-2.a: Quality

This approach is taken if we care more about the quality of our new model and are willing to put in all the necessary time. This approach has a small probability of 20% because this approach can potentially delay and cause unfinished work. However if we decide on quality then we must be willing devote the complete amount of time it is estimated to choose and complete a different mode, which in figure 1B-2 was estimated to be 576 hours in other words an expected cost of 177%.

Initial Cost
Initial cost of the entire model is component 3 of our schedule which we allocated from January 20 to March 25, 2019 , which is about 9 weeks. Each week we allocate 9 hours of outside work per person, and we have 4 member so in total we have 324 hours of outside work for this component in our project. Outside work are work hours we contribute to our project outside of the classroom.

Additional Cost
We estimated that our additional time needed if we were to choose a different model for our Machine Learning American Sign Language software will be 7 weeks, for each member. Our reason is because we will need to reimplement and test the new model our schedule for implementation and testing our original will be from Feb 3 to March 25, which is about 7 weeks.

Initial_Time = Time X People
Time = 9 weeks x 9 hours/ week = 81 hours
People = 4
Initial_Time = 81 hours/person X 4 people = 324 hours

Additional_Time = Time X People
Time = 7 weeks x 9 hours/ week = 63 hours

People = 4
Additional_Time = 63 hours/person X 4 people = 252 hours

Expected Cost is 1.77% or 1.77
Total_Time = Intial_Time + Additional_Time
Total_Time = 324 hours + 252 hours = 576 hours
Expected Cost = Intial_Time + Additional_Time/Initial_Time
Expected Cost = 576 Hours/ 324 hours = 1.77 or 177%

Figure 1.B-2.b: Time

This approach is take if we care more about saving time and less about quality. This approach has a 75% chance of happening since this approach is time expensive and we need to cut it as much as possible, to save time we cut the additional time it takes to choose a new machine learning model specified figure 1.B-2 in in half. The process was originally estimated at 7 week according to figure 1.B-1, now it will be done in 3 weeks.

Initial Cost
Initial cost of the entire model is component 3 of our schedule which we allocated from January 20 to March 25, 2019 , which is about 9 weeks. Each week we allocate 9 hours of outside work per person, and we have 4 member so in total we have 324 hours of outside work for this component in our project.Outside work are work hours we contribute to our project outside of the classroom.

Additional Cost
We estimated that our additional time needed if we were to choose a different model for our Machine Learning American Sign Language software will be 7 weeks, for each member. Our reason is because we will need to reimplement and test the new model our schedule for implementation and testing our original will be from Feb 3 to March 25, which is about 7 weeks.

Initial_Time = Time X People
Time = 9 weeks x 9 hours/ week = 81 hours
People = 4
Initial_Time = 81 hours/person X 4 people = 324 hours

Additional_Time = Time X People
Time = 3 weeks x 9 hours/ week = 27 hours
People = 4
Additional_Time = 27 hours/person X 4 people = 108 hours

Expected Cost is 1.77% or 1.77
Total_Time = Intial_Time + Additional_Time

Total_Time = 324 hours + 108 hours = 432 hours
Expected Cost = Intial_Time + Additional_Time/Initial_Time
Expected Cost = 432 Hours/ 324 hours = 1.33 or 133%

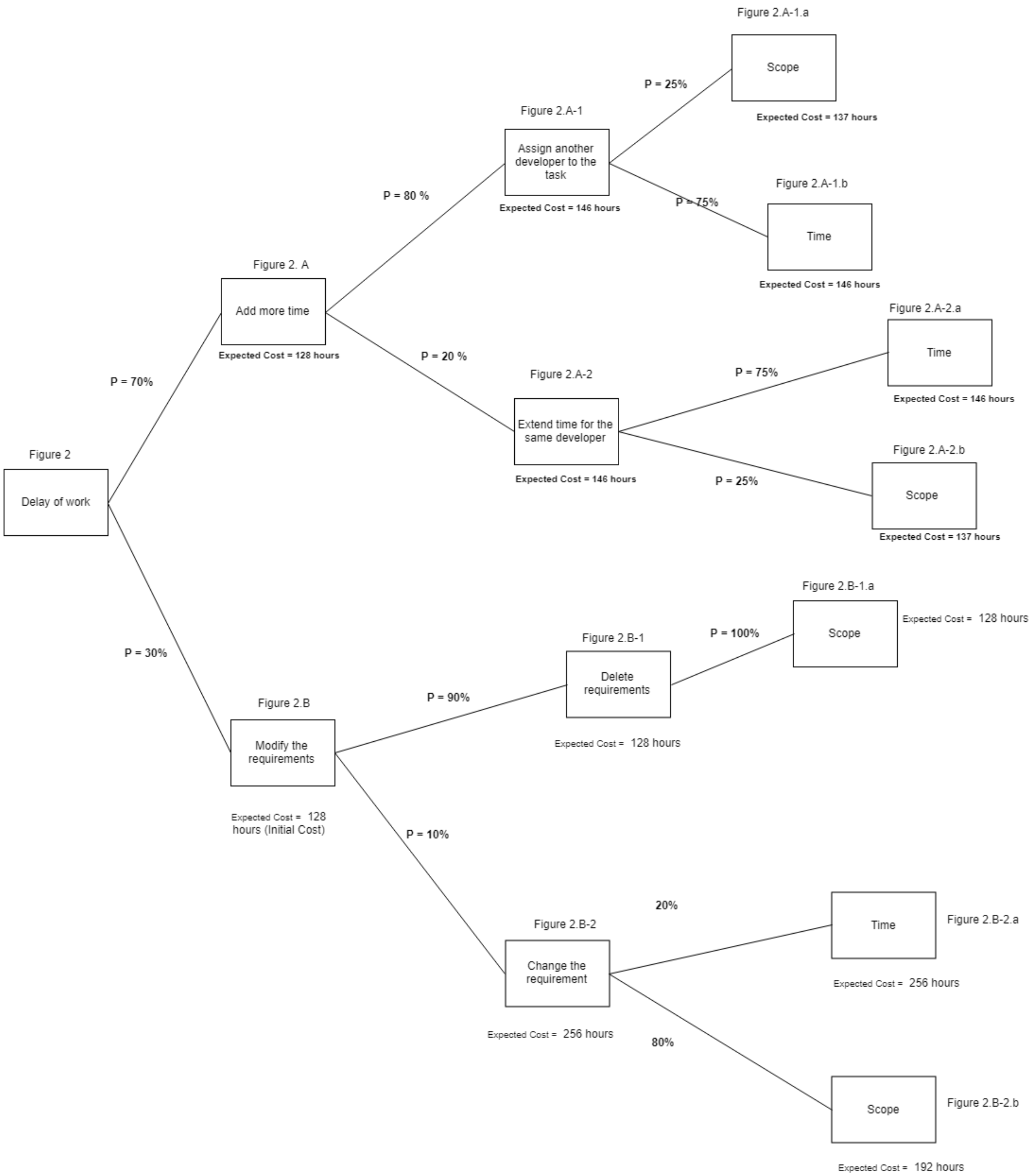


Figure 2
Delay of work
P = 70%
P = 30%
Figure 2. A
Add more time
Expected Cost = 128 hours
P = 80 %
P = 20 %
Figure 2.A-1
Assign another developer to the task
Expected Cost = 146 hours
P = 25%
P = 75%
Figure 2.A-1.a
Scope
Expected Cost = 137 hours
Figure 2.A-1.b
Time
Expected Cost = 146 hours
Figure 2.A-2
Extend time for the same developer
Expected Cost = 146 hours
P = 75%
P = 25%
Figure 2.A-2.a
Time
Expected Cost = 146 hours
Figure 2.A-2.b
Scope
Expected Cost = 137 hours
Figure 2.B
Modify the requirements
Expected Cost = 128 hours (Initial Cost)
P = 90%
P = 10%
Figure 2.B-1
Delete requirements
Expected Cost = 128 hours
P = 100%
Figure 2.B-1.a
Scope
Expected Cost = 128 hours
Figure 2.B-2
Change the requirement
Expected Cost = 256 hours
20%
80%
Time
Figure 2.B-2.a
Expected Cost = 256 hours
Scope
Figure 2.B-2.b
Expected Cost = 192 hours

Figure 2

Figure 2.A: Add more time

If we have delay in our work according to the schedule then one approach is to devote more time to that component. This approach has a 70% chance of happening since we rather finish what we already started. We believe that in most cases devoting more time to work that has already been started improves the quality and completes the scope we set to match.

Initial Cost

The amount of work added will depend on the component being worked on. However, on average each component is being worked on for 25 days, since we have our total days for implementation as 125 and we have 5 components. The initial cost will therefore be the amount of hours spent for each week for each group member. As a team, each group member is expected to work 9 hours a week. If each component latest about 3.5 weeks, with 9 hours per week, for each of our 4 group members then in total each component is devoted about 128 hours.

Initial Cost for person = (Weeks x Hours/Week)
Initial Cost for group = Initial Cost for person x people
Weeks = 25 days/7 = 3.5 weeks
Hours/Week = 9 hours per member
People = 4
Initial Cost for person = 3.5 weeks x 9 Hours/week = 32 hours / person
Initial Cost for group = 32 hours /person x 4 people = 128 hours

Additional Cost

We estimate to that a reasonable amount of time given to complete unfinished work is 1 week.

Additional Cost per Person = Weeks x Hours/Week
Additional Cost for Group = Additional Cost per Person x People
Weeks = 1
Hours/Week = 9
People = 4
Additional Cost per Person = 1 week x 9 Hours/week = 9 hours/person
Additional Cost for Group = 9 hours/person x 4 people = 32 hours

Expected Cost per person
Expected Cost for person = Initial Cost + Additional Cost

Initial Cost per person= 32 hours
Additional Cost per person = 9
Expected Cost for person = 32 hours + 9 hours = 41 hours

Expected Cost per Group
Expected Cost for group = Initial Cost + Additional Cost
Initial Cost per group = 128 hours
Additional Cost per group = 32 hours
Expected Cost for group = 128 hours + 32 hours = 160 hours

<u>Figure 2.A-1: Assign another developer to the task</u>

If we assign another developer to the task then another person will have to help the person currently working on a component. We believe it is better to help a teammate out then let them continue by themselves which is why we gave it a probability of 80%.

<u>Cost Calculation</u>
Since only one additional member will be helping out in the development that was assigned to one person we only have to calculate the an extension for two members. The values used in calculating expected cost are done in Figure 2.A.

Expected Cost = Initial Cost + Additional Cost
Additional Cost = Cost per Person x People
Initial Cost = 128 hours
Cost per Person = 9 hours
People = 2
Additional Cost = 9 x 2 = 18 hours
Expected Cost = 128 hours + 18 hours = 146 hours

<u>Figure 2.A-2: Extend time for the same developer</u>

If we extend time for the same developer then we will give them an additional week. We believe it is better to help a teammate out then let them continue by themselves which is why we gave it a probability of 20%.

<u>Cost Calculation</u>
Since only one additional member will be in work we only need to calculate the additional week given to a single group member. The values used in calculating expected cost are done in Figure 2.A.

Expected Cost = Initial Cost + Additional Cost
Additional Cost = Cost per Person x Weeks
Initial Cost = 128 hours
Cost per Person = 9 hours
Weeks = 2
Additional Cost = 9 x 2 = 18 hours
Expected Cost = 128 hours + 18 hours = 146 hours

<u>Figure 2.A-1.a: Effect Scope</u>

If we decide that time is more important than the scope of the project will be affected since we will have unfinished work. However we believe finishing the work is more important which is why this approach has a 25% chance.

<u>Cost Calculation</u>
Since we choose to save time, we decide to cut the additional time by half.

Expected Cost = Initial Cost + Additional Cost/2
Additional Cost = 9 x 2 = 18 hours
Expected Cost = 128 hours + 18 hours/2 = 137 hours

<u>Figure 2.A-1.b: Effect Time</u>

Since we believe finishing the work is more important this approach has a 75% chance. However, since we decide to completely finish the work this will take up more time.

<u>Cost Calculation</u>
Since we choose to finish our work, the amount of time is the complete expected cost done in Figure 2.A-1

<u>Figure 2.A-1.b: Effect Scope</u>

If we decide that time is more important than the scope of the project will be affected since we will have unfinished work. However we believe finishing the work is more important which is why this approach has a 25% chance.

<u>Cost Calculation</u>
Since we choose to save time, we decide to cut the additional time by half.

Expected Cost = Initial Cost + Additional Cost/2
Additional Cost = 9 x 2 = 18 hours
Expected Cost = 128 hours + 18 hours/2 = 137 hours

Figure 2.A-1.a: Effect Time

Since we believe finishing the work is more important this approach has a 75% chance. However, since we decide to completely finish the work this will take up more time.

Cost Calculation
Since we choose to finish our work, the amount of time is the complete expected cost done
in Figure 2.A-1

Figure 2.B: Modify the requirements

If have delayed work then one approach can be to modify the requirements. However, modifying the requirements can lead to unpredictable consequences in the future which is why we gave it a 30% chance.

Initial Cost
The amount of work added will depend on the component being worked on. However, on average each component is being worked on for 25 days, since we have our total days for implementation as 125 and we have 5 components. The initial cost will therefore be the amount of hours spent for each week for each group member. As a team, each group member is expected to work 9 hours a week. If each component latest about 3.5 weeks, with 9 hours per week, for each of our 4 group members then in total each component is devoted about 128 hours.

Expected Cost
Since modify the requirements itself does not take significant time the cost does not change from initial cost.

Initial Cost for person = (Weeks x Hours/Week)
Initial Cost for group = Initial Cost for person x people
Weeks = 25 days/7 = 3.5 weeks
Hours/Week = 9 hours per member
People = 4
Initial Cost for person = 3.5 weeks x 9 Hours/week = 32 hours / person
Initial Cost for group = 32 hours /person x 4 people = 128 hours

Figure 2.B-1: Delete the Requirement

Editing the requirements can potentially mean starting a component all over from the beginning which includes design, implementation, testing. Since editing cause so much time delay to the point that the requirement might not ever be finish it has a small chance of 10%. Deleting will affect the scope but it will save us time.

Expected Cost
Since deleting the requirement takes up no time or effect, the expected cost from Figure 2.B stays the same.

Figure 2.B-1.a: Effect Scope

If we come to the conclusion of deleting a requirement to save time then that will affect our scope.

Figure 2.B-1.b: Expected Cost

Since deleting the requirement takes up no time or effect, the expected cost from Figure 2.B stays the same.

Figure 2.B-2: Change the Requirement

Editing the requirements can potentially mean starting a component all over from the beginning which includes design, implementation, testing. Since editing cause so much time delay to the point that the requirement might not ever be finish it has a small chance of 10%.

Calculation Cost
If we decide to edit the requirement that can potentially mean starting a component from the beginning. Each component on average takes 25 days, and 128 hours according to the calculations done in Figure 2.B. This means that a single component time was doubled.

Expected Cost = Initial Time * 2
Initial Time = 128 hours
Expected Cost = 128 hours x 2 = 256 hours

Figure 2.B-2.a: Effect Time

If we come to the conclusion of to finish our work to complete the scope we set out to do, then we devote the entire expected cost of changing our requirement. This will affect our time drastically which is why this approach has a change of 20%.

Calculation Cost
Since we decide to complete the expected cost of changing the requirement then the expected cost stays the same as Figure 2.B-2

Figure 2.B-2.b: Expected Scope

If we come to the conclusion that we do not have enough time to spare and need to save as much as possible then we will not complete all the work and therefore the scope will be affected. Since completing a requirement from start to finish effect our time drastically, and might be time we do not have this approach has a change of 80%. We decide to save time we will only devote half the expected time it takes to complete a specific requirement.

Calculation Cost

Since we decided to only devote an additional half of what it takes to complete an entire component then we only need to add our initial time plus one-half of the expected time it takes to finish a component as in Figure 2.B-2.

Expected Cost = Initial Time + (Time to complete/2)
Initial Time = 128 hours
Time to complete = 128
Expected Cost = 128 hours + (128 hours /2) = 192 hours

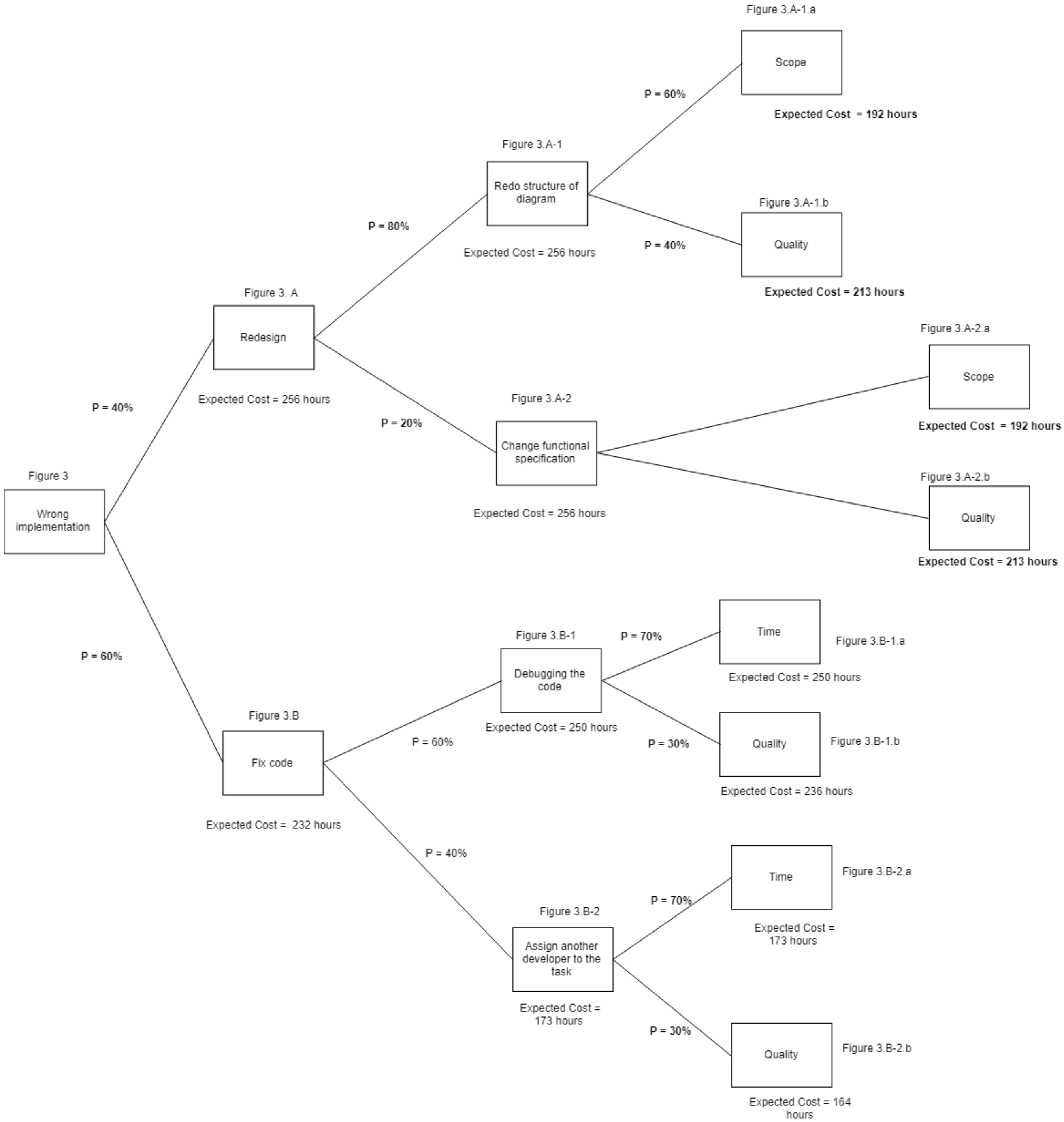


Figure 3

Figure 3.A: Redesign

If our implementation was not correct then that could mean we did not design our component right. Due to time, we rather not step back in our process in our component to redesign which is why this has a probability of 40%. If we design it is like we are starting all over on a component because it took us one cycle to find out in our test phase that our implementation failed. So the total time will be a complete cycle which on average is 25 days times 2.

Cost Calculation
Initial Cost for person = (Weeks x Hours/Week)
Initial Cost for group = Initial Cost for person x people
Weeks = 50 days/7 = 7.1 weeks
Hours/Week = 9 hours per member
People = 4
Initial Cost for person = 7.1 weeks x 9 Hours/week = 64 hours / person
Initial Cost for group = 64 hours /person x 4 people = 256 hours

Figure 3.A-1: Redo Structure of diagram

If we decide to redesign then we feel it is better to start from the beginning. Since we start from the beginning the time allocated for designing will be doubled since it took one cycle to try the first design that fail and it will take another cycle to make a new design. We already calculate the cost of remaking a design in Figure 3.A so the expected cost stays the same.

Initial Cost for person = (Weeks x Hours/Week)
Initial Cost for group = Initial Cost for person x people
Weeks = 50 days/7 = 7.1 weeks
Hours/Week = 9 hours per member
People = 4
Initial Cost for person = 7.1 weeks x 9 Hours/week = 64 hours / person
Initial Cost for group = 64 hours /person x 4 people = 256 hours

Figure 3.A-1.a: Effect Scope

If we decide to lessen the scope in our Design so we could focus on quality then less work will get done but the work that does get done with be better.

Cost Calculation
If we have less work to do then we will waste less time, we estimate that it will only take three fourths(3/4) of the time it takes to redo a structure if we leave work out.

Expected Cost = Expected Cost x (3/4)
Expected Cost = 256 hours
Expected Cost = 256 hours x (3/4) = 192 hours

Figure 3.A-1.b: Affect Quality

If we decide to complete the scope in our design but have less quality then we will get all the work done but will will not be the best work.

Cost Calculation
If we have lessen quality but complete the scope then we estimate the time allocated will be 5/6 of the expected cost to Redo Structure of Diagram.

Expected Cost = Expected Cost x (5/6)
Expected Cost = 256 hours
Expected Cost = 256 hours x (5/6) = 213 hour

Figure 3.A-2: Change functional specification

Changing the functional Specification does not take a long time so the expected time will be the same as Redo Structure of diagram, since we have to redo a diagram if we change the functional specification.

Figure 3.A-2.a: Effect Scope

If we decide to lessen the scope in our Design so we could focus on quality then less work will get done but the work that does get done with be better.

Cost Calculation
If we have less work to do then we will waste less time, we estimate that it will only take three fourths(3/4) of the time it takes to change the functional requirements if we leave work out.

Expected Cost = Expected Cost x (3/4)
Expected Cost = 256 hours
Expected Cost = 256 hours x (3/4) = 192 hours

Figure 3.A-2.b: Affect Quality

If we decide to complete the scope in our design but have less quality then we will get all the work done but will will not be the best work.

Cost Calculation
If we have lessen quality but complete the scope then we estimate the time allocated will be 5/6 of the expected cost to complete the change to the functional requirements.

Expected Cost = Expected Cost x (5/6)
Expected Cost = 256 hours
Expected Cost = 256 hours x (5/6) = 213 hours

Figure 3.B: Fix code

If our code is not functioning properly then we could always just fix it. Since fixing our code is a less time consuming task is it preferred which is why it has a probability of 60%. Fixing code involves re-implementing and re-testing. On average a component takes about 20 days to re-implement and re-test.

Initial Cost = (Weeks x Hours/Week)
Initial Cost = Initial Cost x people
Weeks = 20 days/7 = 2.9 weeks
Hours/Week = 9 hours per member
People = 4
Initial Cost = 2.9 weeks x 9 Hours/week x 4 = 104 hours / person
Expected Cost = Fist cycle time + initial Cost
First Cycle time = 128 hours
Expected Cost = 128 hours + 104 hours = 232 hours

Figure 3.B-1: Debugging

If we decide to fix a code we believe it is most likely that a bug must be in the code.We do not think it is necessary or will be much help if another person tries to re-implement the design on their own. That is why this is the preferred approach of 60%.

Additional Cost
We estimate that our over all time needed for debugging and re-testing will be half week, with all four members contributing.

Initial Cost = (Weeks x Hours/Week)
Initial Cost = Initial Cost x people
Weeks = 20 days/7 = 2.9 weeks
Hours/Week = 9 hours per member
People = 4
Initial Cost = 3.4 weeks x 9 Hours/week x 4 = 122.4 hours / person
Expected Cost = Fist cycle time + initial Cost
First Cycle time = 128 hours
Expected Cost = 128 hours + 122.4 hours = 250 hours

Figure 3.B-1.a: Effect Time

If we decide to do really good job then our quality will be great however this will affect our time. Since we decide to do quality work, we devoted the entire estimated time calculated for debugging that we calculated in Figure 3.B-1, so the expected cost stays the same. This we care about quality we decide to make this the preferred choice of 70%.

Figure 3.B-1.b: Affect Quality

If we decide to do save time then the quality of the work will go down. Our group estimates that the additional cost should be 1 day.

Initial Cost = (Weeks x Hours/Week)
Initial Cost = Initial Cost x people
Weeks = 20 days/7 = 2.9 weeks
Hours/Week = 9 hours per member
People = 4
Initial Cost = 3 weeks x 9 Hours/week x 4 = 108 hours / person
Expected Cost = Fist cycle time + initial Cost
First Cycle time = 128 hours
Expected Cost = 128 hours + 108 hours = 236 hours

Figure 3.B-2 Assigning another developer to the task

If we decide to assigning the take to another developer then that person will have to re-implement and re-test the entire thing on their own. This approach is less likely to be taken because of the pressure it puts on one person instead of the team helping each other to complete the project.

Additional Cost
We believe that it would take the person 5 weeks to re-implement and re-test on their own. This cost is in addition to time spent to do the first cycle.

First Cycle Time = 128 hours
Additional Time = 5 weeks
Hours/Week = 9
People = 1
Expected Cost = First_Cycle_Time + (Additional_Time x Hours/week x people)
Expected Cost = 128 + (5x9x1)
Expected Cost = 173 hours

Figure 3.B-2.a: Effect Time

If we decide to do really good job then our quality will be great however this will affect our time.Since we decide to do quality work, we devoted the entire estimated time calculated for fixing the code that we calculated in Figure 3.B-2, so the expected cost stays the same. This we care about quality we decide to make this the preferred choice of 70%.

Figure 3.B-2.b: Effect Quality

If we decide to do save time then the quality of the work will go down. Our group estimates that the additional cost should be 4 weeks.

First Cycle Time = 128 hours
Additional Time = 4 weeks
Hours/Week = 9
People = 1
Expected Cost = First_Cycle_Time + (Additional_Time x Hours/week x people)
Expected Cost = 128 + (4x9x1)
Expected Cost = 164 hours