AMS 550.400 HW SET 1 Due Date: Oct 8

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Problem 1 (10 pts):
In this problem, I used the following code:
cd ~/550400
mkdir ~/550400/honda
cd ~/550400/honda
git init
vi main.txt
git add .
git commit -m "A is done"
vi main.txt
git add .
git commit -m"B is done"
git checkout -b alt
vi main.txt
git add .
git commit -m"X is done"
git checkout master
vi main.txt
git add .
git commit -m "C is done"
git merge alt
vi main.txt
vi main.txt
git add .
git commit -m "D is done"
git log –graph –oneline
git checkout alt
git log –graph –oneline
git push https://github.com/zhendanzhu/honda.git master
git push https://github.com/zhendanzhu/honda.git alt
The graphs are as following:

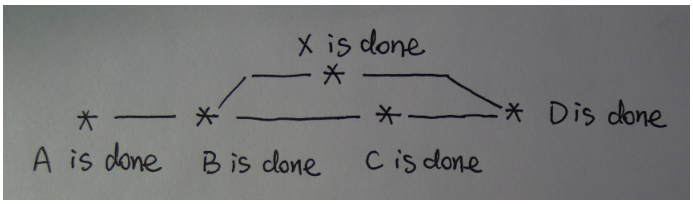


Figure 1: The history graph for master branch

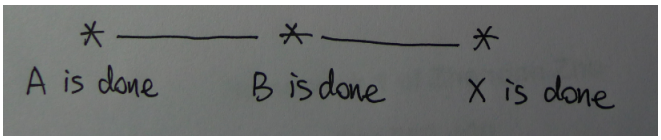


Figure 2: The history graph for alt branch

Problem 2 (10 pts):
mkdir newpoem
cd ~/newpoem
git config –global user.name "zhendanzhu"
git config –global user.email zhendanzhu@hotmail.com
git remote add stanza1 git://github.com/nhlee/550400.stanza1.git
git remote add stanza2 git://github.com/nhlee/550400.stanza2.git
git remote add stanza3 git://github.com/nhlee/550400.stanza3.git
git init
git checkout master
git pull stanza1 master
vi main.txt
git add .
git commit -m " add a title "
git checkout -b alt1
git pull stanza2
git checkout master
git merge alt1
vi main.txt
git add .
git commit -m "resolve conflict1"
git checkout -b alt2
git pull stanza3
git checkout master
vi main.txt
git add .
git commit -m "resolve conflict2"
git remote add origin https://github.com/zhendanzhu/poemmerge.git
git push -u origin master

Problem 3 (40 pts): Consider a team of four students, say, A, B, C and D, who just started working on writing a `latex/beamer` file, say `main.tex`, for a class presentation of their work statement. Assume that they do not wish to coordinate their schedules for a concurrent group meeting (both virtually and physically). Assume that:

- A is in charge of *Introduction*,
- B is of *Problem Statement*,
- C is of *Timeline*,
- D is of *Deliverable* part of the presentation.

In other words, their contributions to `main.tex` do not overlap. Then,

- first, devise a work flow strategy for the team so that they can collaborate asynchronously using `git`,
- next, devise yet another `git` strategy different from your earlier proposal.

Finally,

- discuss the strength and weakness of each of your proposed strategies in terms of merge conflicts resolution,
- make the final recommendation.

In order to answer this question, *build* a mathematical model, *following* the guideline from IMM. Use Section 1.4 and Section 1.5 of IMM as *role models*. For example, you are to identify which variables are exogenous and which are endogenous. More specifically, among other things, in your model, is the preamble part of `main.tex` an endogenous or exogenous variable? Note also that in addition to this issue, there are other issues that you are to consider. So, *be sure to consult IMM*.

Problem: Try to resolve the conflicts between different editions based on workflow design.
In this problem, there are two endogenous variables: the total number of editions and total number of conflicts. The exogenous variable is the total time we spend on the merging part. In our github design, we will try to reduce the time we merge files together. Either increasing total number of editions or the total number of merging conflicts will increase the total time we spend on combining files. When will there be the conflicts? Well, if C is behind the others, say haven't finish the timeline while A B D have already start the work, then there will be a conflict. The best way to solve it is desiging a git process structure to reduce conflicts as well as reduce the total number of editions and save the time in the merging process

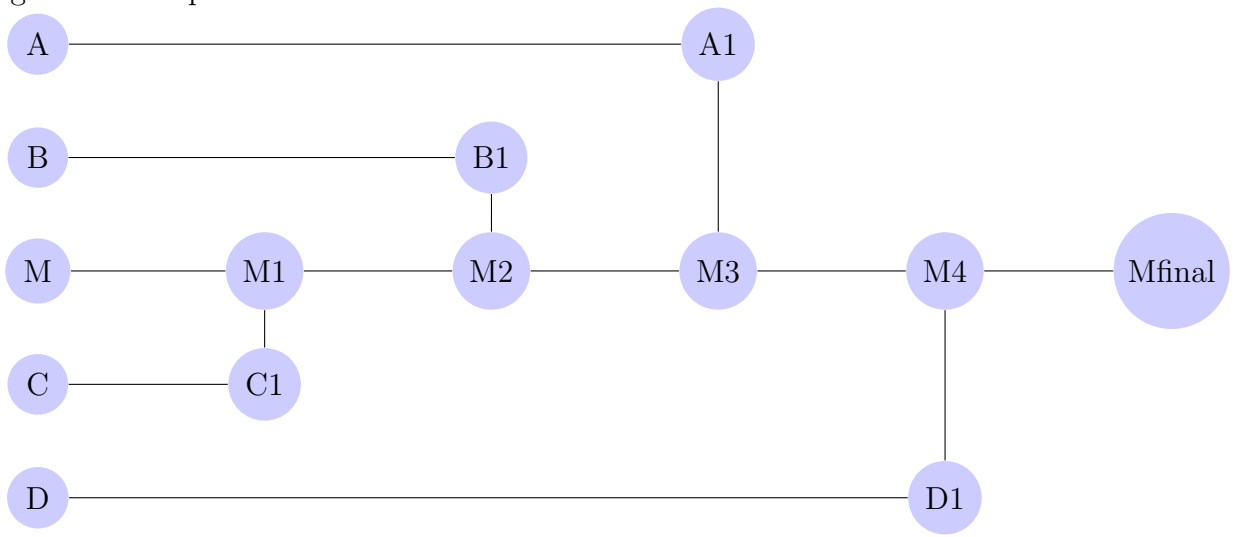
Outline for the model:
Proposal plan 1: We will have only one branch, i.e, all the work will be done in master branch, and each time one finished his work, he can push it back to the master's branch.

The stength for this plan is keeping each person's newest edition updated in time. However,the workflow will be a mess if each one of the team submit the unfinished part.It requires many merges

during the process. We'll lose the efficiency of the project.

Proposal plan 2: Since A ,B ,C and D have relatively independent part of the project, each one can work on his/her own branch first, and merge to the master's branch when it is done. Considering different person may work asynchronously. Each time there's a conflict in merging, we can simply keep what it is for our own part and wait for the other one to update their part . Since C is responsible for timeline, it can be done independently in one file. If eventually C finished first, then A, B, D can follow the timeline to do their part and update their work in a fixed schedule. If C haven't finish his part, then A, B, D can work in a free way as long as they pull the latest edition from the github before they start working on their part.

Strength: Each one of the team will have its independent part, so that we can reduce the times of merge. Keep completeness of each one's work while make a clear outline for the whole process.
Weakness: the number of conflicts will be a headache when B merged his file with master branch if A, C, D updated their part during B's work. So one person may need to solve the conflicts of merge of several person's editions.



Final Recommendation: Plan 2 will be better. Compared with plan 1, it will face less merging conflicts, and thus reduce the time spent on merging effectively. On the other hand, each one of team can keep track of others work (individual branch), each teammates can keep track the continuous process of his or her part of the project .

Problem 4 (aka. Fair Play, 40 pts): Answer the following question:

Is the tennis game fair?

Note that unlike Problem 3, this question is vaguely stated. This is intensional, whence to begin, you will first need to clarify what exactly your question is. You may use the class discussion on this particular problem, but you *may not* directly refer to our discussion. Instead, formulate the model carefully but concisely in your own words.

Original Problem:
Is the game fair? A general standard for this is if the roles of the competitors are reversed, their probability of winning does not change. Our original problem can be breaked down to several parts: whether the player who is first to serve will be in advantage? What will be the chances for the first

game server to win the match given the probability of winning rate for each ball? And to what extent will the advantage be?

Outline for the model: We are going to calculate the probability that the first server to win the match. According to tennis rule, one player delivers the ball to start the game, called server; and one who receives the ball is called receiver. We simplified the rule by stating that each tennis game into a rule that any person who wins two straight points will win the game.And there are 6 games in a match. The possible condition for a game is as following:

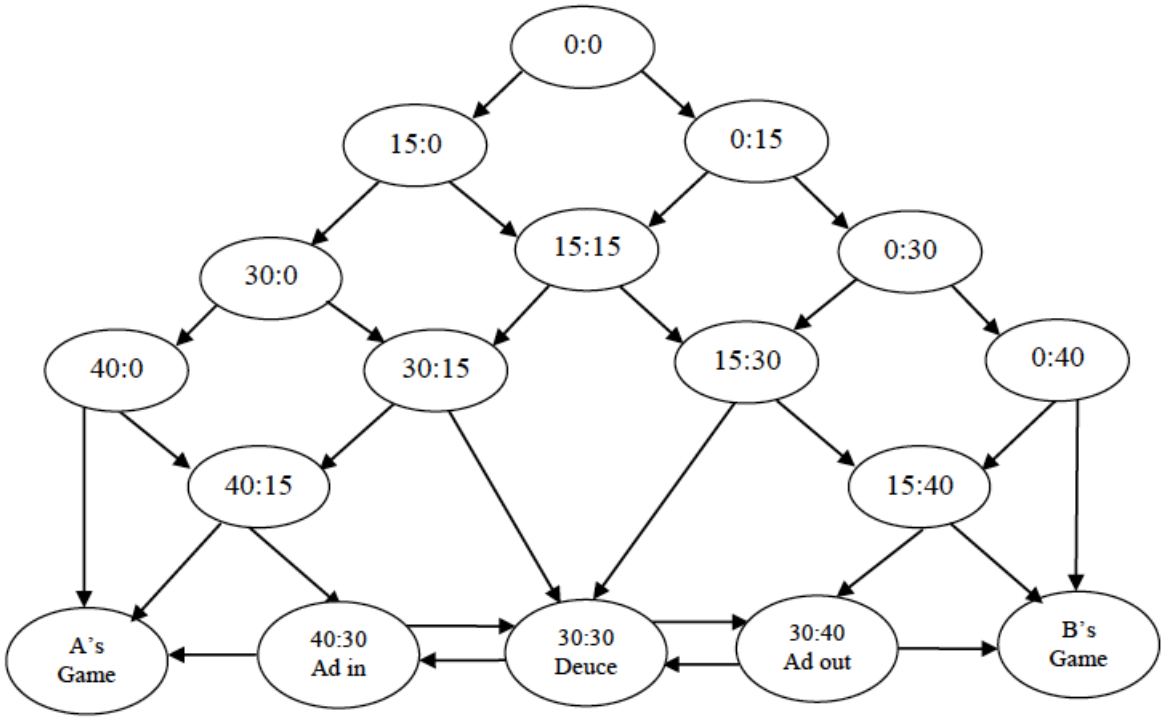


Figure 3: The graph for possible score results

Condition: For both players, the chances for the server to win is P, and the probability for the receiver is $1 - P$.

Formulate the Problem: Whether or not the game is fair depends on the server's winning rate P on each ball. For each player, the chance to win a game is the same, it equals $Q = P^2/(P^2+(1-P)^2)$. The chance to lose the game is $(1 - P)^2/(P^2 + (1 - P)^2)$. If P>1/2, then the winning rate for the server in each game is bigger than 1/2. Given the rule for winning a tennis match is the one who wins the fisrt 6 games will win. The final score can be "6:0", "6:1" , "6:2" ... The total chance for the first server to win is

$$\sum_{k=0}^{5} \binom{k+5}{6} Q^6 (1-Q)^k.$$

The value for this function is show as following

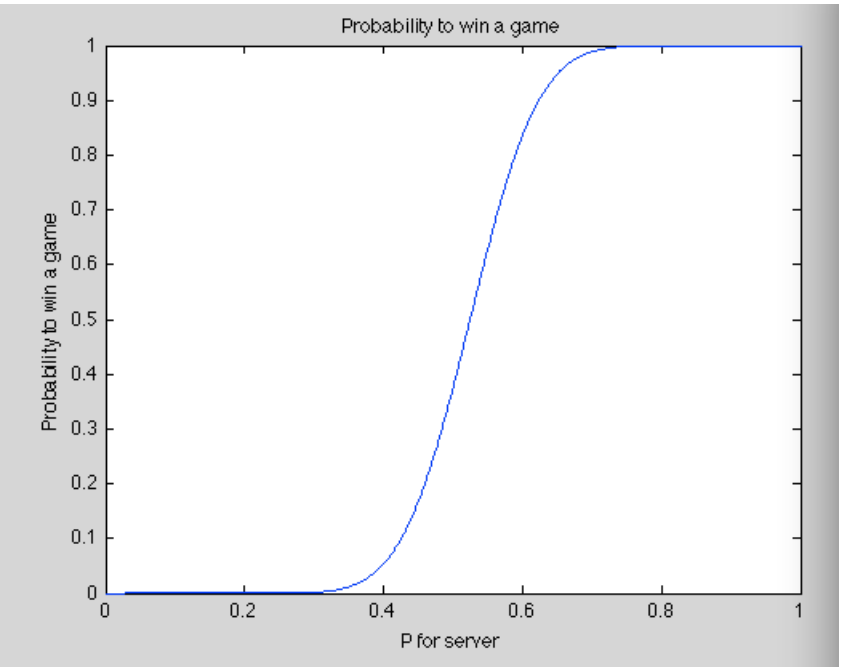


Figure 4: The graph for possible winning rate

Code is as following:

```
b=zeros(1,1000); c=zeros(1,5);
for Q=1:1000;
 for q=1:5;
     p=(Q/1000)^2/((1-Q/1000)^2+(Q/1000)^2);
     c(q+1)=c(q)+binopdf(5,q+5,p)*p;
     b(1,Q)=c(q)+p^6;
     q=q+1;
     c(1)=0;
 end;
  Q=Q+1;
end

a=[0.001:0.001:1];
plot(a,b)
title('Probability to win a game');
xlabel('P for server');
ylabel('Probability to win a game');
```

Figure 5: Matlab code

We will conclude that the fairness of tennis depends on the capability of each player.The stronger the server, the more advantage he will have in the tennis game. Especially, when $P = 1/2$, the game is absolutely fair. Both receiver and server will have fair chance to win each game. On the other hand, if the receiver is strong enough that the chance for him to win each point exceeds $1/2$, then he will have the advantage. So tennis is a fair game if each person has a relatively equal winning rate in both server's game and receiver's game.

Is it useful? In this model, there are several assumptions that needs to be proved. One is we assume that winning rate in each game will be the constant, which may effect by the psychological state of the players and the audiences who are supporting one of the player. But in general, the

model captures the rules of the tennis game as well as the relation between the winning rate in a game and the chance to win the match in the end. So we will test it with real cases and make the final conclustion.

Test the model

We are going to use the historical data to back test the estimated rate. The best way is compare the winning rate when he starts as server with the winning rate when he starts as receiver against the same player. Then we are going to compare if there's significant difference between these two rates with statitistical analysis.

Final Remarks about Problem 3 & Problem 4: They are open-ended problems. However, your scores will be determined by how well do you follow the exposition style outlined by IMM and WMA. For both problems, your write-up should be

- self-contained,
- covering all four parts of Section 1.3 of IMM,
- paying a particular attention to any causal relation that you might be investigating, following Chapter 3 of WMA,
- answering questions that are explicitly asked in the problem statements.

For Problem 3, focus mostly on Step 2 and Step 3 of Section 1.3 of IMM. For Problem 4, focus mostly on Step 1 and Step 2. For each problem, minimum 1 pages and maximum 2 pages.