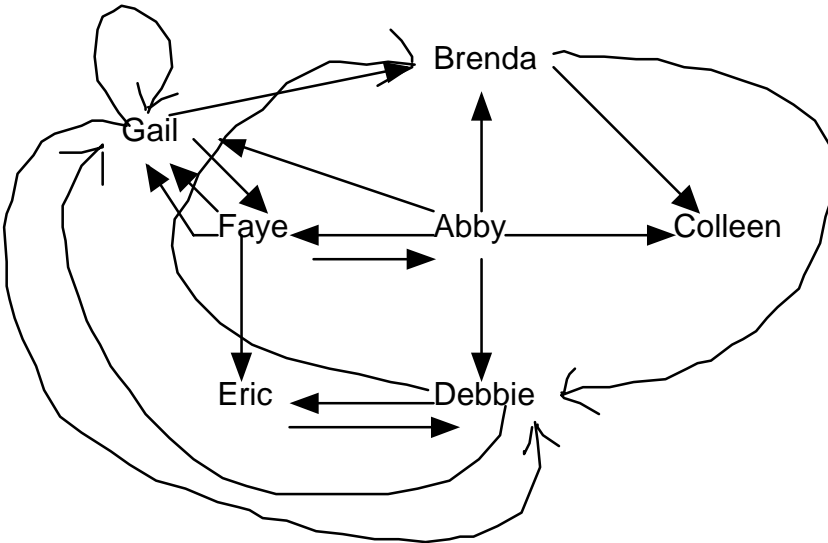


Directed Graphs WS KEY

High School Soap Opera:

Abby (Miss Social) will phone her 'girlfriends', Brenda, Colleen, Debbie, Faye (her best friend), and Gail. Faye will call Abby but everyone else is sick and tired of Abby's big mouth so they never call her. Brenda will only call her two best friends Colleen and Debbie. Debbie likes Brenda and will call her, but Debbie thinks Colleen is stuck up and therefore Debbie will not call Colleen. Colleen, who is very shy, is really not stuck up. Also, her mother is very strict and will not allow her to make any outgoing calls. Debbie has a boyfriend named Eric (a real hunk - NHS member, 'A' student in math, captain of the football team, etc.) whom she calls quite often and who frequently calls her because they are "in love". Faye is jealous of Debbie and wants to steal Eric away from her. Therefore, Faye calls Eric, who is in her math class, with the excuse that she needs his help with her math homework and then ends up flirting with him. Eric being 'true' to Debbie (because he is "in love") calls no one except Debbie. Faye will also call her friend Gail who is very rich. Debbie will also call Gail. Gail will call Faye, Brenda, and Debbie, but does not like or call the misunderstood Colleen. Gail has a second phone which is a mobile phone in her BMW. She has only given this number out to Faye. Gail only uses the mobile phone to receive calls from Faye or to 'call herself' by calling her house phone and leaving herself reminder messages on her answering machine. She never uses her house phone to call her mobile phone.

1) Neatly draw the directed graph illustrating the phone calling connections. (Note: There is only one 'Gail' node.)



2) Complete the adjacency matrix for this problem. (Note: There should be 19 connections.)

		TO						
		Abby	Brenda	Colleen	Debbie	Eric	Faye	Gail
FROM	Abby	0	1	1	1	0	1	1
	Brenda	0	0	1	1	0	0	0
	Colleen	0	0	0	0	0	0	0
	Debbie	0	1	0	0	1	0	1
	Eric	0	0	0	1	0	0	0
	Faye	1	0	0	0	1	0	2
	Gail	0	1	0	1	0	1	1

3) Because Faye dislikes Debbie and wants to break Debbie and Eric up, Faye starts a rumor over the phone to all her connections. The rumor is that Debbie is going to drop Eric for Norman the computer geek because Eric likes Faye better than Debbie and has been going out with Faye behind Debbie's back. There is no direct connection from Faye to Debbie but a message (rumor) can get from Faye to Debbie by four indirect connection paths (routes) using two calls. List the four possible routes. (ex. Chris to Sean to Sue)

- a) Faye to Gail to Debbie
- b) Faye to Gail (mobile) to Debbie
- c) Faye to Abby to Debbie
- d) Faye to Eric to Debbie

4) Brenda has just heard a juicy piece of gossip (which is not really true but Brenda does not know that). She has heard that Eric has been secretly going out with Faye and that Faye is pregnant with Eric's child. Brenda knows that for everyone to hear the gossip it needs to reach Abby.

- a) What is the least number of connections (calls) that need to be made to get a message from Brenda to Abby?
- b) Write the entire 'FROM Brenda' row from a matrix that supports the answer to part a).

4a) 4

4b) 1 4 1 2 4 1 6

5) Abby - no longer Faye's best friend since Faye has been hanging around Gail so much and Abby had to hear of Faye's "pregnancy" from someone else - wants to let Debbie know what a _____ (fill in your own noun) that Faye is. Find the total number of ways of getting a message from Abby to Debbie in four calls or less. (Hint: Have one person use the original matrix, another person find the matrix squared, another one find the matrix cubed, and another find the matrix to the fourth power.)

5) $(1+2+9+20=)$ 32

6) Colleen is home in tears because Abby has just told her that everyone thinks she is stuck up. What is the least number of connections (calls) that Colleen can make to Debbie, Faye, and Gail to explain how hurt she feels that they all think that way of her?

6) none

7) Faye, now trying to stop the untrue gossip about her, wants to get a message to Gail and everyone else that she is really innocent and just being misunderstood. There are 5353 ways (not the total) that Faye can get a message to Gail by using the same number of calls for each of the 5353 ways. How many calls did it take to arrive at this answer?

7) 9

Epilogue:

After seeing Gail's mobile phone bill her parents take the phone away. In a pouting snit Gail storms out of her house with her fake ID, gets drunk, rolls her BMW and has been in a coma since that day. Abby got cancer of the throat, lost her voice and died as a lonely spinster. Brenda moved to Alaska and is now raising Huskies. Colleen (an 'A' student in math) became a famous super model and has a successful workout video that she is selling at a maximum profit. Debbie and Eric went off to different colleges and finally did split up. Debbie (an 'A' student in math) is happily married and also has a successful career as an electrical engineer. Eric got hurt in football and while recovering became a rich Chippendale dancer. Faye ended up failing all her math tests, dropped out of school, moved to L.A. and became a poor prostitute.

Moral: Don't talk on the phone and get good grades in math!