**Home Page Discussion**

**Topic 1:  Flowcharting**

For many people, understanding a process begins with a sketch.  If they can’t depict a situation using boxes, arrows, stick figures, abbreviations and whatever, then they don’t feel they really know what’s going on.

Flowcharting is nothing more than a disciplined way of sketching.  It helps people organize their thoughts, and also communicate those thoughts to others.  Even a rough sketch can be useful.  Many flowcharts been scrawled on whiteboards, tabletops, cocktail napkins, and the backs of envelopes.

Flowcharts can help us get our heads around new processes.  They can also help us describe existing processes, either for training purposes, or the goal of improving them.  Flowcharts are used in many different disciplines, each having its own set of symbols and conventions;  if you’re a software engineer, for example, you’re familiar with flowchart symbols standing for I/O devices, processing spaces, and online storage.  If you’re working in telecommunications or simulations technology, you’ve doubtless seen at least one SDL diagram, which is a specialized type of flowchart.

In this Module, we’ll use a bare-bones set of flowchart symbols:  activities, decisions, connectors, and endpoints, connected by arrows.  This is analogous to a made-up language consisting of nothing but nouns, verbs, modifiers, periods, and a rudimentary positional grammar.  Not enough for the “real world,” but adequate for training purposes.

Please see TUIOPM (2014a), a PPT deck which describes the elements of flowcharting, and presents a worked-out example.  For additional background, you can read an excellent overview published by Air University (AU, 2013), and Murphy’s (2005) short summary.  For even more information, use Google to search “Flowchart” and “Flowcharting.”  There are thousands of related sites on the Web.

Have you done the reading?  If not, then stop – you should at least take a look at the PPT deck.  If you’ve done the reading, then here are some additional tips.  Read and study them before attempting the Case.

0.  Flowcharting requires a lot of empirical trial and error (aka fiddling around).  Start with a big piece of paper, a soft lead pencil, and a block eraser.  The eraser is important – you’ll need it. Other people find it convenient to use a whiteboard or a chalk board.  One creative soul wrote out all the activities and decisions on 3X5 cards, laid them out on the floor, then put down soda straws to connect them.  Once she had a layout she liked, she took a picture of it.

1.  Do not mix activities and decisions.  Separate them.  Here’s an example, representing actions taken when a woman who’s about to have a baby appears at the front desk of a hospital.  If she’s already been admitted (preadmitted), she’s given a bed in the OB/GYN ward;  otherwise, she’s sent to the admissions office, and admitted.  Following admission, she’s sent to the ward.

|  |  |
| --- | --- |
| The flowchart on the right is NOT correct.  A decision is implied in the first rectangular box, which should contain an activity, and only one activity. | https://tlc.trident.edu/content/enforced/63517-OPM300-SEP2015FT-1/flowchart1.JPG?_&d2lSessionVal=kILVv8HNqM7HwoZC3kVJH3zL2&ou=63517 |

|  |  |
| --- | --- |
| The flowchart on the right IS correct.  The activities and the decisions are clearly separated. | https://tlc.trident.edu/content/enforced/63517-OPM300-SEP2015FT-1/flowchart2.JPG?_&d2lSessionVal=kILVv8HNqM7HwoZC3kVJH3zL2&ou=63517 |

2.  Use a consistent flow direction.  Usually, a process is flowcharted from left to right, or from up to down, although there may be some loops (as shown in TUIOPM, 2014a) where the flow temporarily reverses.  Since you have to indicate direction, always be sure to include arrowheads on the connecting lines.  This seems obvious, but it’s sometimes overlooked.

3.  Avoid clutter.  Rather than trying to fit a large flowchart onto one page, use connectors to spread it across two or more pages.  TUIOPM (2014a) shows you how to do that.

4.  Use only the prescribed symbols.  If using MS Word, create a drawing canvas, then use standard shapes (rectangles, lozenges, arrows).  On the Word ribbon, click on Insert.  In the Illustrations group, click on Shapes.  For more information about inserting shapes, see MS Word Help.

5.  Don’t overload the flowchart with text.  If the activities or descriptions don’t lend themselves to short descriptions, simply label the activities and decision A, B, C… and so forth, and provide a glossary.   Here’s how the example above would appear if you wanted to describe the various steps in more detail, but couldn’t fit all the information into the body of the flowchart.

|  |  |
| --- | --- |
| GLOSSARY    Start:  Pregnant woman arrives at the receiving desk of the hospital. A.  Is she already admitted?  B.  Assigned a bed in the OB/GYN ward.  C.  Sent to admissions office  D.  Admitted. | https://tlc.trident.edu/content/enforced/63517-OPM300-SEP2015FT-1/flowchart3.JPG?_&d2lSessionVal=kILVv8HNqM7HwoZC3kVJH3zL2&ou=63517 |

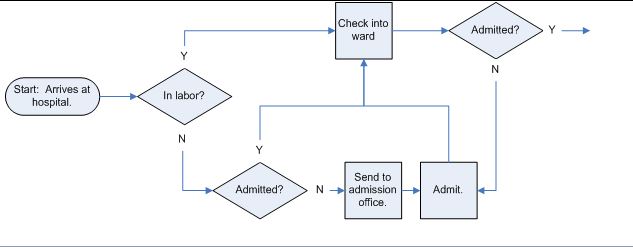
This technique is particularly useful if you’re drawing the flowchart by hand, and don’t want to do a lot of lettering.  Below, we’ve drawn the same flowchart on white paper with a Sharpie, taken a digital picture of it, and pasted the image (in .pdf format) into the document[1]

|  |  |
| --- | --- |
| GLOSSARY    Start:  Pregnant woman arrives at the receiving desk of the hospital. A.  Is she already admitted?  B.  Assigned a bed in the OB/GYN ward.  C.  Sent to admissions office  D.  Admitted. | https://tlc.trident.edu/content/enforced/63517-OPM300-SEP2015FT-1/flowchart4.JPG?_&d2lSessionVal=kILVv8HNqM7HwoZC3kVJH3zL2&ou=63517 |

6.  Identify different decisions, and put them into different boxes.  For an example, let’s make the process above a bit more complicated.

A woman about to deliver presents at the hospital front desk.  If she’s been admitted already, she goes straight to the ward;  otherwise, she is sent to the admissions office, admitted, then sent to the ward.  However: if she’s in labor, she goes straight to the ward.  If she’s not admitted already, then the staff admits her at bedside.

Here’s one solution.



Notice that the same activity appears twice;  which is, the check for whether the patient has been admitted.  If she’s not in labor, and was admitted before checking into the ward, then the second check of her admission status (after checking into the ward) is purely notional.  It doesn’t pertain to her, but it does pertain to others, and that’s why it appears again at this point in the flowchart.

We can convince ourselves that the flowchart is correct by listing all the possible ways a patient can present, then verifying that there’s a path corresponding to each of them.

Patient presentations:

1. In labor, admitted.
2. In labor, not admitted.
3. Not in labor, admitted.
4. Not in labor, not admitted.

Paths:

1. Patient presents.  Patient is in labor.  Patient is checked into the ward.  Admission status is verified.  Process continues to the right.
2. Patient presents.  Patient is in labor.  Patient is checked into ward.  Admission status is checked, and the patient has not been admitted.  Patient is admitted while in the ward.  (The arrow goes back to the ward, but the patient is already there.  Admission status is nominally checked again, but this time she’s been admitted.)  Process continues to the right.
3. Patient presents.  Patient is not in labor.  Patient is already admitted.  Patient is checked into the ward.  Admission status is verified.  Process continues to the right.
4. Patient presents.  Patient is not is labor.  Patient has not been admitted. Patient is sent to admissions office.  Patient is admitted.  Patient is checked into the ward. Admission status is verified.  Process continues to the right.

TEST YOUR UNDERSTANDING:

Redraw the flowchart above, with the following change.  The first check, after the patient presents, is not whether she’s in labor, but whether she’s been admitted.  Present the new flowchart with a glossary:  that is, label the various activities and decision A, B, C,   etc. and provide a list explaining each label.

The answer appears at the bottom of the SLP page.  Don’t peek!  Try it first.

**Topic 2:  The Delphi Method**

**Where do Estimates Come From?**

Throughout the remainder of the course, we’ll be using various estimates.  Here are some examples.

In Module 2 (Decision Trees), one of the examples states, “If the IT system were upgraded, then there’s a 40% chance (i.e., a 0.40 probability) that (some entity) would buy (the company)…”  If the 0.40 figure happens to be wrong, then any decision based on it will also be wrong.  So the obvious question is, where did that figure come from, and what gives us a warm feeling that it’s right?

In Module 3 (PERT-CPM), each Case problem begins with a list of project tasks, along with three estimated completion times for each;  the optimistic (shortest) time, the pessimistic (longest) time, and the most likely (somewhere-in-between) time.  These times are the necessary starting point for the problem;  but where did they come from?  In this instance, of course, the person who devised the problem simply made them up.  But if you were using PERT-CPM to run a real-world project, such as building a factory, you’d need time estimates that had some basis in reality. Where would you get them?

In Module 4 (Linear Programming), one of the examples begins with the statement, “An electronics firm produces a calculator.  Customer demand is for 100 … calculators per day.”  Oh, really?  Is that the average demand over the past year, the demand yesterday, the seasonally-weighted daily demand, or something else entirely?  Whatever it may be, it’s only useful to the extent that it accurately reflects *future* customer demand.  After all, production decisions must be made on the basis of what a company *expects* to sell, not what it’s sold in the past.  So that 100-per-day number needs to be seen as a forecast.  Who made that forecast, and how reliable is it?

**About Methods**

There’s an entire discipline, called Decision Science, that’s dedicated to answering questions like that.  Speaking broadly, it employs two methods;  the quantitative method, and the qualitative method.  Those are the ends of a spectrum;  there are a lot of mixed methods in between.

The quantitative method is based upon numbers.  It begins with what’s happened in the past, as reflected in historical data, and goes on to predict what’s going to happen in the future.  Still speaking broadly, the quantitative method uses two types of models:  time-series models, and associative models.  Time-series models are discussed in terms of things like weighted moving averages, exponential smoothing and trend projection, while associative models are discussed in terms of clustering, multivariate correlation and statistical significance.  The quantitative method is used in courses such as Econometrics, Actuarial Science and Business Research Methods, and we will not discuss it further here.

Qualitative methods, as opposed to quantitative methods, are not based on numbers and computations, but rather on expert opinion, personal experience, intuition and informed guesswork.  Again, there are several methods – but we’ll limit our attention to only one, the so-called Delphi Method.

**The Delphi Method – Why?**

The Delphi Method begins with the opinions of a group of experts.  It follows a procedure that attempts to arrive at an expert consensus, or at least a position that reflects the full range of expert opinion, while avoiding some of the hazards of group decision making.  One of those hazards is groupthink.

Groupthink (Janis, 1982) occurs when a group arrives at a more extreme judgment, or decision, than any single member of the group would have arrived at if acting alone.  Janis (1982) developed the theory following his analyses of the Vietnam War, the Cuban Missile Crisis, and the Bay of Pigs fiasco, during which some men[2], supposedly among the smartest in America, did some astonishingly stupid things.

An extreme example of groupthink is the Abilene Paradox (Harvey, 1988).  When a group is caught up in a so-called “trip to Abilene,” it does something collectively *that not one single one* of them would have done individually.  The classic Abilene punch line, voiced by every member of the group in the aftermath of the debacle, is “But I thought *you* all wanted to do it.  I thought I was going along with everyone else!”  One example cited by Harvey (1988) was the Watergate scandal of the Nixon administration, in which every member of the President’s team wound up supporting an illegal course of action that none of them thought was a good idea.

The exact mechanism underlying groupthink is still the subject of research, but it is generally understood to be related to the social experiences of group membership.  The group may be maintaining a positive collective identity, avoiding a threat to its existence, or relying, inappropriately, on its past history of success (Esser, 1998).

The goal of the Delphi Method is to obtain the benefits of group decision-making, while avoiding the biases arising from group membership, such as groupthink.

**The Delphi Method – How?**

The key elements of the Delphi are anonymity, repetition, and controlled feedback.  Here’s how it works.

A person charged with making a decision, the Delphi coordinator, contacts a panel of experts.  Each expert is told that his or her identity will not be shared with the others.  The coordinator shares the facts and issues bearing on the decision each expert, obtains an recommendation, summarizes it, and forwards it to the others.  In the second round, the coordinator invites each expert to submit a revised recommendation, amended (or not) after considering the recommendations of the others.  The coordinator then summarizes and shares the revised recommendations.  The procedure continues, either through a fixed number of iterations, or until a consensus is achieved, or until the coordinator is convinced that all sides of the question have been expressed and adequately explored.

The technique was devised by the RAND Corporation in the early 1950’s, in support of a secret Air Force project assessing American vulnerability to a nuclear attack.  The question was;  from an enemy’s point of view, which factories would be the most lucrative targets?  A primitive computer program, assessing the value of factories in terms of their floor space, was producing nonsense.  It was obvious that a small factory producing one key product, such as a specialty alloy used in jet engines, would be a greater loss to the nation that a sprawling plant that stamped out automobile tires.  The RAND researchers had the bright idea of actually asking the experts who worked in various industries, and compiling their opinions.  Anonymity and controlled feedback were, in the first instance, motivated by the need for secrecy;  obviously, it would not do for an enemy to discover which industrial installations the US Air Force considered the country’s most valuable!

**Some Background**

Here’s some worthwhile background reading on Delphi.

Dalkey (1969) did some early research on the technique, and wrote a report for his employer, the RAND Corporation.  The paper (available online) is not only interesting, but entertaining, being full of throwaway lines such as, “Wisdom is opinion with charisma” ( pg. 2).

In addition to Esser (1998), mentioned above, the following authors offer good overviews of Delphi:  Okoli and Pawlowski (2004),  Ladenta (2006), and Linstone and Turoff (2011).  Ladenta (2006) provides a valuable summary of various criticisms that have been leveled at the Delphi over the years.  These include questions such as

* Who’s an expert?
* Is an expert consensus always the best solution?
* What are the limitations of anonymous interaction?  Does it reduce motivation?  Increase the number of poorly-thought-out responses?
* How susceptible are the results to manipulation, either intentional or unintentional, by the coordinator?
* Does the time required adversely affect the outcome?

Despite these questions, Ladenta provides evidence that the Delphi is at least as good as the alternative decision-making processes.  And any formal decision-making process is preferable to one person’s uninformed opinion.

**Delphi in OPM300**

The Session-Long Project (SLP), which does, in this instance, span the entire session, consists of a Delphi decision-making process.  For an outline of all four assignments, plus a detailed example, please see TUIOPM (2014b).  For specific requirements, please see the SLP page of each module, beginning below.

1. If taking a picture using a webcam.  select the highest resolution.  Save the image as a .pdf file.  After pasting the image into Word, click on it, then click Picture Tools on the Word toolbar.  Use the “Crop” tool to remove extraneous material from the margins.  Size the image by clicking and dragging one corner, then position it on the page.  Putting it into one cell of a two-cell table, and descriptive text in the other cell, is a good way to save some space.

2. The use of sexist language is intentional.  It would be unfair to include women

Complete the first round of a three-round Delphi decision-making exercise.  Before reading further, please be sure you’ve read the discussion about the Delphi process on this Module’s Homepage.  It includes information that is not repeated here.

*Topic:*

For the sake of simplicity, choose a future outcome that can be expressed as a single-number probability, or likelihood.  Examples include

* The likelihood that X will be elected (to some office) in 20##.
* The likelihood that Y will win the Super Bowl / World Series / NBA Championship in 20##.
* The percentage of feature films that will consist entirely of computer-generated imagery by the year 20##.

The topic should be something that both you and your exercise participants care about, and also know something about (although you need not be experts).

*Participants:*

You will be the coordinator.  Select three other persons as participants.  Their cooperation will be important, so be sure to choose people you can count on.  These can be either family members, close friends, or other students (although not students enrolled in *this* course.  They’ll be busy coordinating their own Delphi exercises.)

As closely as possible, the SLP should follow the detailed example, which is cited in the Home Page discussion.  You may copy and / or adapt verbiage from the example without citing it.  (This special dispensation is intended to help move things along.)

The SLP writeup should include

* The Letters to the Participants, explaining the project and requesting their assistance.
* The first-round responses from the participants, edited to remove identifying information (such as email addresses).
* **Three-Round Delphi Exercise (Example)**
* **R. Rensvold / Oct 2014**
* **FIRST ROUND**
* ***Coordinator’s Letter***
* ***(Send a separate letter to each participant)***
* Hi Tom/Dick/Harry,
* I need a favor.
* I’m enrolled in a college course, and I need to do a Delphi decision exercise with at least three other participants. I’d like you to be one of them. It’ll be fun!
* Here’s how it works.
* I’m going to ask you to estimate the likelihood of something specific happening. A likelihood is a number ranging anywhere between 0% and 100%, where
* 0% = there’s no way it could *ever* happen (like the Sun rising in the West).
* 50% = there’s a fifty-fifty chance of it happening (like a coin coming up heads)
* 100% = it’s absolutely certain to happen (like the Sun rising in the East).
* The “something specific” is something you know about, care about, and have thought about, but don’t necessarily have any expert knowledge about.
* Along with your likelihood estimate, please list all the things that may push that event towards happening, or tend to keep it from happening.
* I’ll be collecting the same information from two other people, sharing it with you, then asking you if you’d like to revise your estimate. This will happen twice.
* Here’s what I’d like you to estimate.
* **Question: What is the likelihood of Hillary Clinton being elected President in 2016?**
* Please answer with a number between 1% and 100%
* Then, please list all the reasons you can think of why, or why not, that may happen.
* That’s all! Could you please get that information to me in the next day or two?
* Thanks a lot,
* R2
* ***First Round Responses***
* ***(copied verbatim from participant responses)***
* From Tom: I think she has an 80% chance. There are a lot of middle-aged women who admire her, who sympathize with her for having had to put up with Bill, and think it’s time for a woman to be President. The main thing holding her back would be her family. She just became a grandmother, and after all the stuff she’s gone though in her public life, she may be ready to shuck it all and just be Granny.
* From Dick: Only 50%. And she’s got the best chance of any Democrat. The thing holding her back will be the enthusiasm of the Democratic base. I mean, a lot of liberals think she’s just another big-business warmonger; she voted for the Iraq War, after all. So Democrats may or may not come out for her. The Republicans, on the other hand, will absolutely hate the idea of having Bill back in the White House. They’ll vote for sure, and they’ll vote against Hillary.
* From Harry: Only 40%. It all comes down to money. The Democrats don’t have the billionaire supporters the Republicans do – just look at the Koch brothers! Given enough money, they’ll be able to convince the voters that Hillary is a socialistic, atheistic, gun-hating, gay-loving anti-family abortionist peacenik, and a bad cook to boot. Money talks and BS walks!
* **SECOND ROUND**
* ***Coordinator’s Letters***
* -----
* Hi Tom,
* Here are the results of the first round. You’re not seeing the names of the other two participants, and they’re not seeing your name, either.
* Question:
* What’s the likelihood of Hillary being elected in 2016?
* Your response: 80%
* Reasons why:
* Admired by older women
* Women think it’s time for a woman President
* Reasons why not:
* May not want to – a new grandmother!
* X’s response: 50%  
   Reasons why:
* Best chance of any Democrat
* Reasons why not:
* Democratic liberal base may not be enthusiastic
* Republicans will be enthusiastically against
* Y’s response: 40%
* Reasons why:
* None given.
* Reasons why not:
* Republican big-money donors will outspend the Democrats
* Intensive advertising will sway the electorate against Hillary
* On this basis of these responses, please revise your own estimate. Send it to me, along with your revised list of reasons why and reasons why not.
* Thanks a lot!
* R2
* -----
* Hi Dick,
* Here are the results of the first round. You’re not seeing the names of the other two participants, and they’re not seeing your name, either.
* Question:
* What’s the likelihood of Hillary being elected in 2016?
* Your response: 50%  
   Reasons why:
* Best chance of any Democrat
* Reasons why not:
* Democratic liberal base may not be enthusiastic
* Republicans will be enthusiastically against
* X’s response: 80%
* Reasons why:
* Admired by older women
* Women think it’s time for a woman President
* Reasons why not:
* May not want to – a new grandmother!
* Y’s response: 40%
* Reasons why:
* None given.
* Reasons why not:
* Republican big-money donors will outspend the Democrats
* Intensive advertising will sway the electorate against Hillary
* On this basis of these responses, please revise your own estimate. Send it to me, along with your revised list of reasons why and reasons why not.
* Thanks a lot!
* R2
* -----
* Hi Harry,
* Here are the results of the first round. You’re not seeing the names of the other two participants, and they’re not seeing your name, either.
* Question:
* What’s the likelihood of Hillary being elected in 2016?
* Your response: 40%
* Reasons why:
* None given.
* Reasons why not:
* Republican big-money donors will outspend the Democrats
* Intensive advertising will sway the electorate against Hillary
* X’s response: 80%
* Reasons why:
* Admired by older women
* Women think it’s time for a woman President
* Reasons why not:
* May not want to – a new grandmother!
* Y’s response: 50%  
   Reasons why:
* Best chance of any Democrat
* Reasons why not:
* Democratic liberal base may not be enthusiastic
* Republicans will be enthusiastically against
* On this basis of these responses, please revise your own estimate. Send it to me, along with your revised list of reasons why and reasons why not.
* Thanks a lot!
* ***Second Round Responses:***
* ***(As in First Round: Copied verbatim from participant’s responses)***
* From Tom:
* From Dick:
* From Harry:
* **THIRD ROUND**
* ***Coordinator’s Letters***
* (Similar to the above, but summarizing the second round responses and asking for another revision.)
* ***Third Round Responses:***
* ***(As in the first two Rounds: Copied verbatim from participant’s responses)***
* From Tom:
* From Dick:
* From Harry:
* ***Third Round Summary:***
* ***(Letter sent to each of the participants)***