WASHINGTON STATE UNIVERSITY
World Class. Face to Face.

Dr Holt's CCPM Games

Sixes

BASIC Sixes Game

- Sixes is a quick game to demonstrate the reasons individuals feel justified in adding safety to individual task estimates. It makes it very clear why this has been done and why it was critical and necessary for people who try to keep their promises. (Helps people understand why they act the way they do.)

- Sixes demonstrates how the inflated safety imbedded in individual task estimates required by BAD STATISTICS can be safely removed and replaced with a relatively small project buffer for much better project performance in spite of the same, continued highly skewed probability distributions associated with of individual tasks. (Helps people understand the simple actions needed for the system to dramatically improve.)

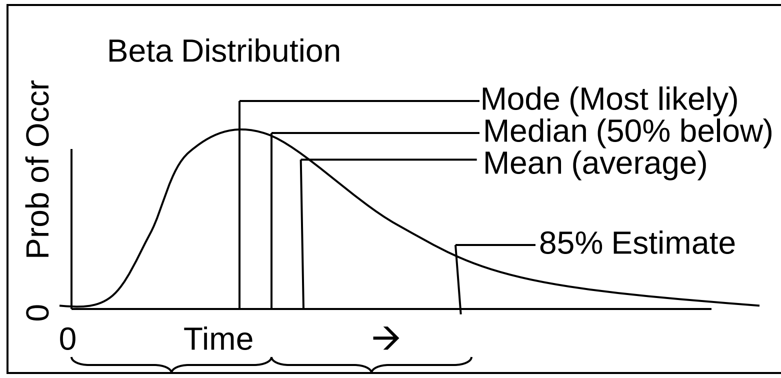
Advanced Uses of the Sixes Game

- The advanced portion of Sixes allows inquisitive individuals to further investigate and consider the impacts of variability on project systems.
- They can also help teach specific principles important to Project Management:
  - Dealing with Erroneous Reporting (not reporting complete with the task is complete)
  - Dealing with An Errant Task.
  - One area is the impact of reduced variability
  - One area is the impact of assembly

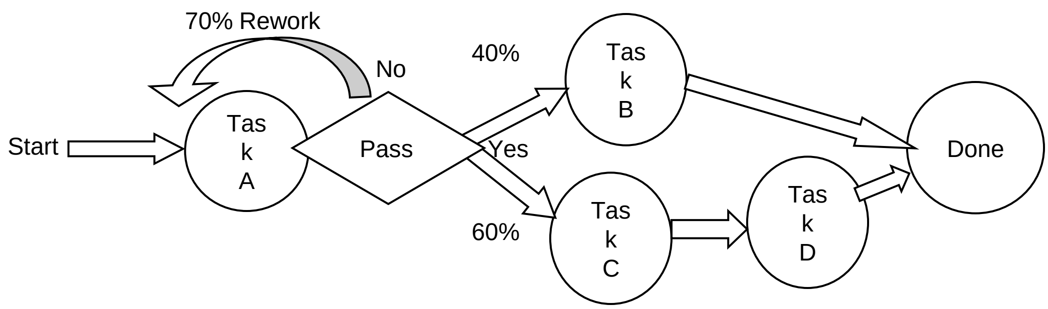
BEFORE YOU PLAY, Understand the Structure of Individual Tasks

•The beta curve is widely accepted by academics to represent the theoretical distribution for individual tasks.

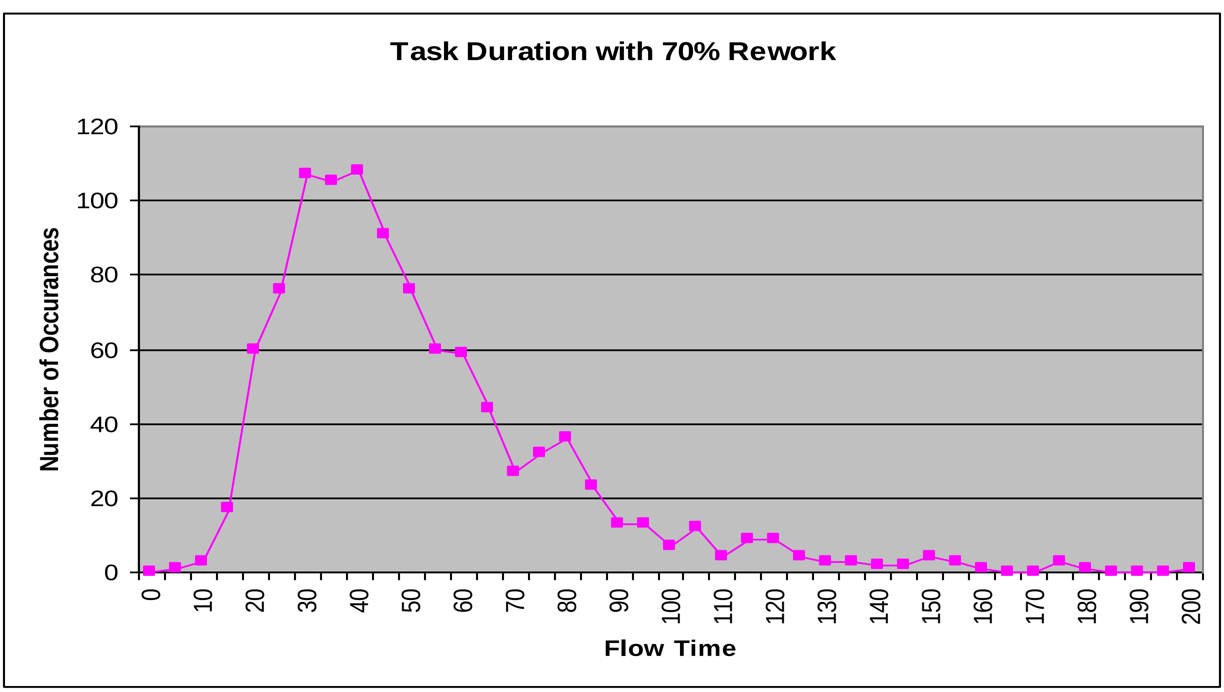
•When working on a different problem, I simulated a case with a high degree of rework. Amazingly, I found the same shape curve; the Beta Distribution.



•In words, the process stared with Task A which had 70% rework. When Task A finally finished, there was a 40% chance of a short path through Task B and a 60% chance of a long process through Task C and Task D. In this case all Tasks had a Mean of 10 days and a Standard Deviation of 4 Days.



•A simulation of 1000 runs shows the Mean time from Start to Done is 49 days with a Standard Deviation of 30 days. But the Maximum time was over 200 days and an 85% time of 80 days. Median about 40 days. We see the same Beta Distribution. The cause is the high amount of Rework. We now see a core problem for individual tasks and great opportunity!



Duplicating the Beta Distribution with Dice

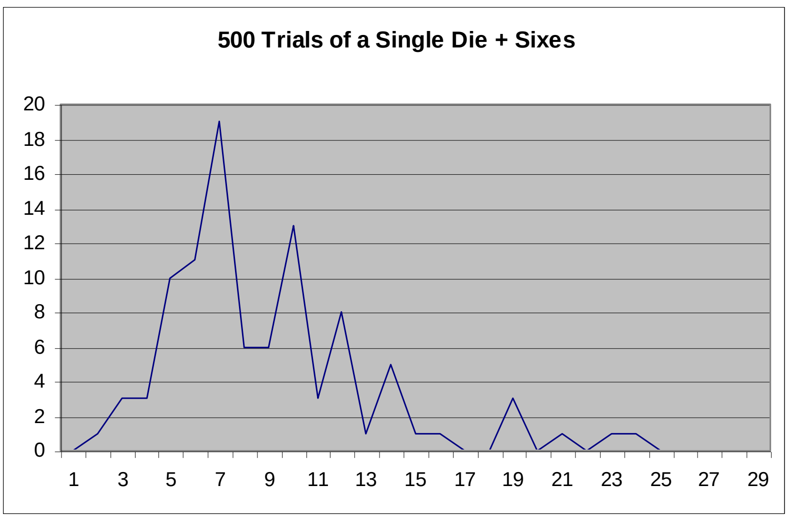
It's possible to simulate the Beta Distribution results using fair die. Here is a simple simulation of two processes.

One process is rolling a single die (representing the a normal process with wide variation, mean 3.5 days, standard deviation 1.7) producing a number from 1 to 6.

The other process is rolling the die and counting the number of rolls until there is a six rolled (the probability of rolling a six in one roll is 0.166. The probability of rolling a six is exactly two rolls is 0.139. And the probability of rolling a six in two rolls or less is 0.305. There is a 95% probability of rolling a six in 17 rolls or less (and a 5% chance it will be more than 17).

When you add these two processes together (the number rolled on a single fair die + the number of rolls needed to roll a six), you get a distribution that resembles the Beta. A distribution that has a general, predictable portion and an un-predicable portion causing the long tail.

Below is a sample of 500 trials of a single die plus Sixes.



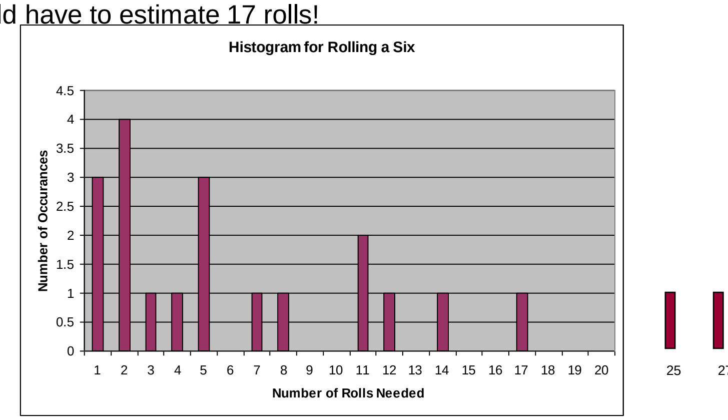
While it's possible to do create the Beta Distribution used in projects in this way, its cumbersome in a game. So, in the Sixes Game, we ignore the predictable part (the fair die predictable part) and just focus on the unpredictable portion of project tasks. Removing the predictable part doesn't seem to detract from the Sixes Game at all and simplifies things.

Now that you have the background, you are ready to play Sixes!

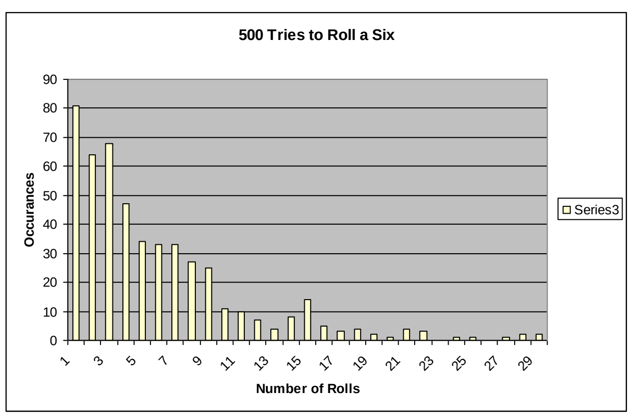
Playing the Sixes Game

Giving the Group the deeper understanding of the actions of a fair die:

- Gather a group of interested people. Ten to twenty people is good. Give each person a fair die.
- First, review the characteristics of a fair die. Make sure they all know the probability of rolling a six is 1/6th or 16.7%.
- Ask them how many times they expect to roll the dice to get a six. What is the minimum number of rolls necessary to get a six:? (1) What is the maximum number of rolls to get a six? (No upper limit).
- To better understand this, let's make a histogram to see how many rolls it takes you to get a six. Each of you roll your die until the get a six. Count how many rolls it takes. The leader plots the Histogram of the data points. If you don't have at least 20 people, have some people repeat their rolling until you get at least 20 data points (20 is easy to use since each data point represents 5%)
- Make the Histogram. You may get something like below. In this case two of the rolls were beyond 20! So, to be 90% (18/20), you would have to estimate 17 rolls!



- And yet, 60% of the time (by this Histogram), it only took five rolls or less.
- If the distribution of the histogram is not clear enough, ask them to do it again to get 20 more data points. You need to plot 40 or 50 samples on the same histogram to get a good understanding for the distribution. You will find that about 1/6th (17%) are sixes on the first roll and about 50% of the time, it takes 4 rolls. 2/3rd (67%) of the time, a six occurs within six rolls. But an 85% comfort level takes about 10 rolls and 95% at 17.



- Explain, **it's not the person rolling the dice but the nature of the process**.
- Ask if any one rolled a six on the first time and the second time. If they did, have every one watch them to see if they can do it again.

Sixes Game

- **The Game:**

Now people understand the probability distribution of rolling a Six, you are ready to do a project. The project is for everyone to roll a six. Each person counts how many rolls were necessary to roll the six. We add together all the rolls to see how many rolls it takes for everyone to get a six. That's the game.

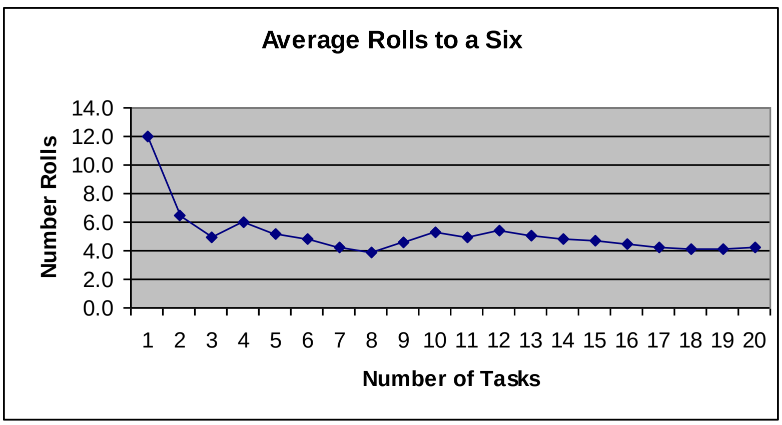
- **The Set-Up:**
- To represent the general nature of a person's desire to Deliver to Promise, we will add an artificial incentive. Each person will be asked to bet on their estimate. (You won't actually collect the money, just ask them to access their feelings of commitment to the process by wagering their position of comfort relative to the rewards.)
- Tell them, "We are now going to let every one roll until they get a six. I want to write down your estimate of how many rolls it will take you to roll a six.
- "But, before you make your estimate for your rolls, I want to let you know I AM THE MANAGER! I WILL HOLD YOU ACCOUNTABLE TO YOUR COMMITTMENT!
- "To make sure that you understand your commitment, I want each of you to put a dollar bill on the table before you give me your estimate. If you roll your estimate or less, you keep your dollar and share in the profits of the project. If you miss your estimate (delay the project), you loss your dollar.
- "Now what is your estimate?"
- Write down the estimates on a chalk board or paper (best if everyone can see). You will get many 20+ estimates. After they are all down, add them up. The number will be too high. Tell them with this high number, the company will not win the project. So, they are all out of work!
- **Discussion to obtain a more reasonable estimate:**
- Discuss how too much padding really isn't necessary. Try to commit them all to no more than 20 rolls, then no more than 18 rolls, 17, 16 and finally 15 rolls. If they don't accept, they are fired and play with whoever is left. If they do accept, then add up the numbers. Realize that the project time is still too long! (Its 15 times the number playing). Emphasis they will make the bid. Turn around and say, "Sorry we didn't win the bid. We took too long." Discuss that you think they can win the contract if the number was one third less (at 10 rolls per person). Ask them if they should bid on the project? If they agree to bid the project too easily, ask for 9 rolls per person and then 8 rolls per person. Just so you know, there is a 99% chance of completing a project of more than ten people in less than 8 rolls per person.
- Write down what the group agrees to do. The target should be around 10 rolls per person or less. (If some choose not to play below 15, then let them drop out.)
- Before you actually play the game, point out the ridiculously low estimate for the project! The First Estimate was X (about 20 * the people) the next was Y (about 15 times the people) and now we are at Z (some much lower number around 10* the people).
- Say, "Because of this ridiculously low estimate, I will not hold you accountable or your estimate. Put your Dollar bill back in your pocket."
- **Now play the game:** Add up the total rolls. The total rolls of all the players should be much less time than even your lowest estimate (95% of the time).

Sixes Discussion

Make sure to have a good discussion about the outcome of the game/project.

- How did the group do in relation to the original estimates?
- Why do you think the outcome was much lower?
- Did anyone have to roll a high number of times (over 15)? If so, why didn't it derail the project?
- How is it that working together, we can complete so quickly when it is perfectly clear each person needed more rolls to be secure?
- How can we apply this to our own environment?

- You may wish to draw the figure below that shows how the average number of rolls it takes per person to roll a six generally declines with the more people (number of tasks) in the system.



- From a CCPM point of view, the median value for rolling a six is 4. That is, 50% of the time, you should be able to roll a six within four rolls.
- Let's assume in the game you just played, you had ten people and decided on estimating 10 rolls per person. That makes the project estimate 100.
- In reality, you had something close to 60.
- Now, if we take an aggressive schedule based upon the Median value of 4 per person, the un-buffered Critical Chain is 40. Adding back half of what was removed ((100-40)/2 = 30 for the Project Buffer, puts the Buffered project at 40+30 or 70 Rolls.
- Bidding a project such as this (bidding on 70 rolls) when others would be very fearful to bid 100 days gives you a tremendous market advantage.

Advanced Applications
Dealing with Erroneous Reporting

Background on Erroneous Reporting

A major problem in projects is Parkinson's Law: Work expands to fill the time available. Coupled with that is the importance of individual perception. If I negotiate to get ten days for my task and am able to finish earlier, there is a tendency to report on the due date and not prior. These human behaviors associated with interdependency and highly variable tasks come from the positive ethical desires of "delivering to your promise" and "providing the best quality possible". While both highly desirable, the behaviors can block the benefits of CCPM. Together these behaviors are called Erroneous Reporting. As a rule of thumb, 75% of people will not report an early completion after negotiating for a delivery date.

You can could demonstrate the negative impact of this by giving every one a due date (say ten rolls) in the Sixes Game. Play Sixes counting the number of rolls to get a six. If the number is less than ten, then roll once more. If the last roll is a Six, report the actual number which was less than ten, otherwise report ten or more according to the previous rolls. Such a trial with twenty people results in something like two less than ten, sixteen tens and two more than ten; a very large number. This exercise is worthy for the instructor, but not so much for the students. Its better to play the following:

The Manager Element

Have everyone play the Sixes Game again. Have them record the number of rolls to gain a six. We will be using this same roll several times. They don't need to roll again.

The Lazy Manager: The Lazy Manager has a Monthly Accounting from each of his project members. We simulate this by the Lazy Manager asking, "How many of you were finished by 20 rolls?" Here, 20 is considered the 20 work days of the month. Out of 20 people, about 18 will be less than 20 rolls. That would be 18*20 days =360 days. Then, the Lazy Manager asks, "How many of the rest finished by 40 Days?" Probably the other two finished within 40 days so 2*40 days = 80 more days for a total of 440 days. The Lazy Manager is fired.

The New Manager: The New Manager has every one report every two weeks. The New Manager asks, "How many of you completed within 10 days?" About 13 report completion, 13*10=130 days. "How many more completed within 20 days?" Five more for 5*20=100 days. "How many finished in the next 10 days (30 days)?" Two more for 2*30=60 days. The total then is 130+100+30 or 260 days. The New Manager is much, much faster than the Lazy Manager. The New Manager is promoted.

The Second New Manager arrives and learns from the previous New Manager: The Second New Manager requires reporting every week. Let's see what the count is?
For 5 days, 9 tasks. For 10 days 4 tasks. For 15 days 3 tasks. For 20 days, 1 Task. For 25 days, 0 tasks. For 30 days, 1 task. Total: 9*5+4*10+3*15+1*20+0*25+1*30= 180 days. The Second New Manager is promoted.

The Third New Manager arrives and proposes to report EVERY DAY!

Advanced Applications
Dealing with Erroneous Reporting (continued)

What do you suppose will happen when Every Task is reported upon every day?

First, it is a difficult task to collect all this information.

Second, it may actually slow down the workers.

Third, it may tie up the Project Manager Daily!

Hum? How could this NOT be difficult to collect?

Hum? How could this NOT slow down the workers?

Hum? How could this NOT tie up the Project Manager in minutia?

We need a quick and easy way to get the data. A secretary can collect the data within one minute per task (once every one gets used to it).

What data are needed? Four Questions:

1. Did you complete the Active Task Yet?

If not: 2. How Much Time is Remaining?

If not: 3. What are you awaiting? (good to know for record and analysis)

If not: 4. What can we do to help you?

Is all of these questions worth it?

Let's see. From the same data we had before, lets list the rolls in ascending order:

1,1,1,2,3,3,4,5,5,6,7,9,10,11,13,14,19,21,28 for a total of 163 days. Which is much less than 180 and much, much less than 260 and hugely different than 440 days of the previous mangers. IT IS WORTH THE EFFORT!

Discussion:

What additional impacts will Daily Reporting have on the people involved in executing their tasks?

(The discussion should discover: People will recognize the urgency of completing tasks. People will disconnect the 'Due Date' from the actual completion of the task. People who give Time Remaining, gives a better daily view of actual project buffer status. Having a list of "what is holding up our process" is extremely valuable for process improvement and planning. The "How can I help you?" question may actually provide help to lingering tasks.)

Will Daily Reporting basically eliminate Erroneous Reporting problems? (Yes, if the four questions are asked daily and without much discussion or penalty and WITH ASSISTANCE as needed.)

Advanced Applications
Dealing with Errant Tasks

Background on Errant Tasks

It's evident rolling a Six has nothing to do with the person doing the task. It's a function of the process. And, a die with a low success rate per roll can be highly frustrating. By now, you have had a lot of fun pointing to people who had to roll more than 20 times to get a six. It's in good fun because the individuals know it's not their fault. It's the system.

So how to FIX the system?

Dealing with Errant Tasks

At this point, we are stuck with the six sided die. So, how can we assist a person who is having a terrible time rolling a six?

First, what is 'terrible'? Hum? Well, if the mean number of rolls to get a six is less than 5 and 80% less than 10, rolling more than 10 is a 'terrible'!

What can we do to assist a person how has already rolled 10 times without a six?

It makes sense to help. But how? Here is an area where you can teach about a Resource Buffer for Projects. That is, if the project takes 20 resources, there should probably be some extra resources (say two people) who are available to help with Errant Tasks.

These people helping might be people who completed rolling a Six serendipitously, or someone in reserve. Even the Project Manager could pick up a fair die and assist someone with an Errant Task.

How would this work?

If a person rolls 10 times but has not rolled a six, there is a RESOURCE ALERT. Remember, we are doing Daily Reporting, so this is pretty easy to identify. When a task creates the RESOURCE ALERT, an other available resource comes to assist with the Errant Task. On roll 11, both the original resource rolls and the assisting resource rolls. This doubles the probability of rolling a six and should close out the errant task quickly.

Don't get caught up in sending four people there. One assistant is usually sufficient to complete the Errant Task promptly.

Don't push for the assistant too soon either. Yes, it would be fastest if every resource who had already rolled a six would help any other task which had not. But don't get carried away. Rather, treat the Errant Task as a rare occurrence and let it be dealt with routinely and efficiently; not too early, and not too late. That is the message.

Discussion:

How can we do this within our own work place?

Advanced Applications
Dealing with Variability in Tasks

Background on Variability in Tasks

In the Sixes Game, the probability of a first throw success is only 1/6th (0.1666 or 16.7%) This is a poor first pass yield. With such a poor performance, almost any efforts to improve things would improve the fist pass yield.

Let's consider just a few of the CCPM methods that can improve First Pass Yield all by themselves:

1. All information is available before you start. This not only simplifies the task effort but reduces the amount of reworks as additional information becomes available.

2. Minimized Multi-tasking. Shifting from task to task not only takes time but is distracting and leads to missing something.

3. No artificial due date. If the earlier tasks are passing on partially completed tasks just to be on time, this will create tremendous problems down the line.

These three items can dramatically improve first pass yield. But, is it a big deal?

What is the impact of Reducing Variability?

For fun, let's approach this Variability Reduction thing slowly to see what difference it makes in the larger scheme of things. First, let's assume we found a way to make minimal improvement. We improve the first pass yield from 1 in 6 to 1 in 5. Suppose we are trying to roll a six but there are only five sides on the die (we will not count the roll if we roll a one, we will just roll again). What will be the impact of a first pass yield of 1/5th (0.20 or 20%)? This is only a 3.3% improvement on first pass yield. What impact will it have on our System Performance?

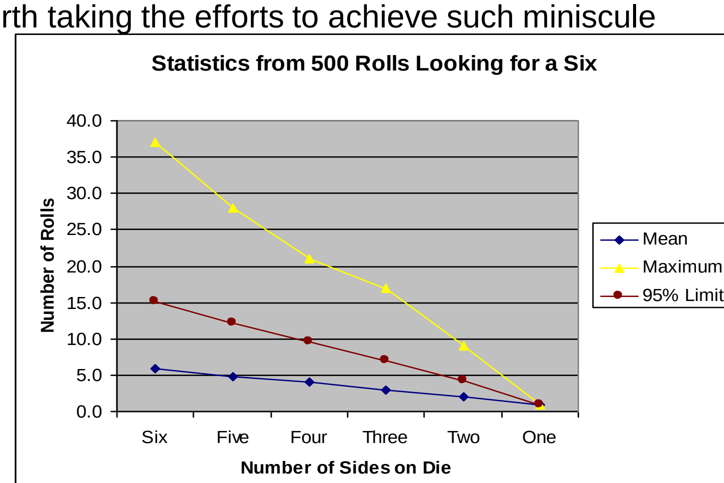
Discussion:

What improvement did you see from your previous rolls with a six sided die?

What improvement would you see if you could improve to a 1 success in 4 (a 25% first pass yield)? Where does the improvement come from?

Is the systemic improvement worth taking the efforts to achieve such miniscule improvements?

Note to instructor: While the median doesn't change much, the outliers go away with the fewer sides (improved first pass yield). Coupling this Variability Reduction Technique with the Errant Task Reduction method can really deliver exceptional performance.

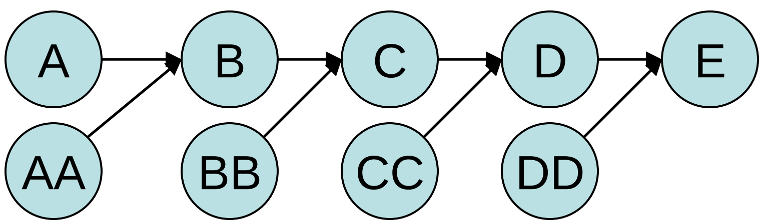


Advanced Applications
Dealing with Assembly

Background on Feeder Buffers

The basic understanding of the need for Feeder Buffers comes from the Assembly Buffer in Drum-Buffer-Rope. However, Feeder Buffers are more valuable than the Assembly Buffer. You need to realize their importance, and their un-importance. That is, the impact of the Feeder Buffer is different as you progress along the Critical Chain. At the beginning of the Critical Chain, a Feeder Buffer is likely too small. But, later along the Chain (if the project has not been rescheduled) the Feeder Buffers do exactly what you want them to do; Feeder Buffers protect the Project Completion to a much higher extent than you realize. The effective size of the Feeder Buffer grows as the Project Buffer in penetrated. Hence, a Feeder Buffer of two weeks long can effectively be six weeks long if the Project Buffer has been consumed by four weeks.

To play the Sixes Assembly Game, you need nine people (five on the Critical Path and four representing individual feeder sub-chains). And, it takes a bit of careful play to realize exactly what is happening. Arrange the people as follows:



Task AA is a feeding chain parallel to Task A. Both Task A and Task AA must be complete before Task B can start. And the same with the other feeding chains.

First play this game using a **Traditional Project Management** method. Let's use about a 95% safe estimate of 16 days for each task. In the traditional Project Management Tasks will report their task duration as the planned duration 83.3% even if they finish early or the actual finish if they finish later.

The Traditional Plan then starts Tasks A & AA at time 0. Task BB begins at time 16, and Task B begins either at time 16 when Tasks A & AA complete, if after time 16. Task CC is planned to begin at time 32 and Task DD at time 48. The project is planned to end atter Task E completes (planned to start at time 64) or about 80 days (5 * 16 days).

To do this simulation, print out the forms on the next page (you'll need at least two copies so you can get it right).

To play the simulation, you call out the days (meaning one roll per day) and the tasks record the time they complete. If the task rolls a six earlier than the estimate, the task rolls the die one more time and if it's another six, the early completion is reported, otherwise the estimate or the actual completion time (whichever is longer) is reported.

Make sure that the latest completion time of the predecessors becomes the actual starting time of Tasks B, C, D and E.

Play the Traditional Project Simulation. About 60% of the time, you will actually meet the 80 Day Expected Completion time. About 40% late.

Advanced Applications
Dealing with Assembly

Task A Traditional

Planned Begin	Est.	Planned End
0	16	16
Actual Begin	**Numb Rolls**	**Actual End**
0		

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task B Traditional

Planned Begin	Est.	Planned End
16	16	32
Actual Begin	**Numb Rolls**	**Actual End**

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task C Traditional

Planned Begin	Est.	Planned End
32	16	48
Actual Begin	**Numb Rolls**	**Actual End**

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task D Traditional

Planned Begin	Est.	Planned End
48	16	64
Actual Begin	**Numb Rolls**	**Actual End**

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task E Traditional

Planned Begin	Est.	Planned End
64	16	80
Actual Begin	**Numb Rolls**	**Actual End**

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task AA Traditional

Planned Begin	Est.	Planned End
0	16	16
Actual Begin	**Numb Rolls**	**Actual End**
0		

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task BB Traditional

Planned Begin	Est.	Planned End
16	16	32
Actual Begin	**Numb Rolls**	**Actual End**
16		

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task CC Traditional

Planned Begin	Est.	Planned End
32	16	48
Actual Begin	**Numb Rolls**	**Actual End**
32		

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task DD Traditional

Planned Begin	Est.	Planned End
48	16	64
Actual Begin	**Numb Rolls**	**Actual End**
48		

(Roll extra 6 to report early)
(Feed actual End time to Task B)

The CCPM Feeder Buffers

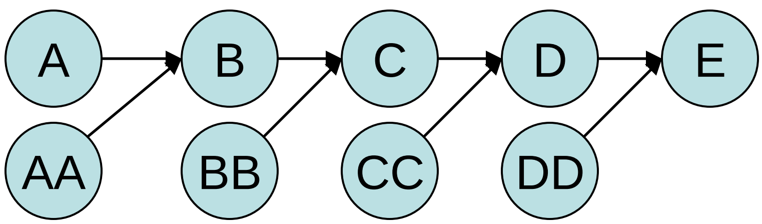
Using the Same Project Layout, now consider the situation with a CCPM Schedule including Feeder Buffers.

To make this simulation work, we will cut the 95% estimate of 16 in half to an estimate of 8 rolls to get a Six (Note to instructor, because of the single task on the feeding chain, this simulation won't work well if you reduce the estimated time for rolling a six to the actual mean of just below 5. Using 8 as the aggressive schedule works fine enough.)

The Critical Chain estimate is then 40 days and adding 20 days as a 50% Project Buffer. The project Promise Date is 60 days.

The Feeder task are also 8 days with a 50% Feeder Buffer of 4 days.

To play the CCPM Version, we use the same nine people as before (five on the Critical Chain and four representing individual feeder sub-chains). And, it takes a bit of careful play to realize exactly what is happening. Arrange the people as follows:



Again Task AA is a feeding chain parallel to Task A. Both Task A and Task AA must be complete before Task B can start. And the same with the other feeding chains. Now, because Task AA is estimated at 8 days with a 4 day Feeder Buffer. Task A is also estimated at 8 Days without a Feeder Buffer. The correct way to schedule Task AA is to start it four days before Task A (the correct CCPM method), however, for this simulation, we will start Task AA at the same time as Task A (meaning the Feeder Buffer for Task AA was totally consumed at the project start).

The other Feeder Tasks, BB, CC, DD are each offset to start four days earlier than their parallel companions (respectively B, C and D).

We play this simulation similar to the last one. The sheets on the next page can help you keep track of the start an finish. (print at least two copies).

To play the simulation, you call out the days (meaning one roll per day) and the tasks record the time they complete. If the task rolls a six earlier than the estimate, the task rolls the die one more time and if it's another six, the early completion is reported, otherwise the estimate or the actual completion time (whichever is longer) is reported. Yes, there is also erroneous reporting in this simulation.

Make sure that the latest completion time of the predecessors becomes the actual starting time of Tasks B, C, D and E.

Advanced Applications
Dealing with Assembly

Task A CCPM

Planned Begin	Est.	Planned End
0	8	8
Actual Begin	**Numb Rolls**	**Actual End**
0		

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task B CCPM

Planned Begin	Est.	Planned End
8	8	16
Actual Begin	**Numb Rolls**	**Actual End**

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task C CCPM

Planned Begin	Est.	Planned End
16	8	24
Actual Begin	**Numb Rolls**	**Actual End**

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task D CCPM

Planned Begin	Est.	Planned End
24	8	32
Actual Begin	**Numb Rolls**	**Actual End**

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task E CCPM

Planned Begin	Est.	Planned End
32	8	40
Actual Begin	**Numb Rolls**	**Actual End**

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task AA CCPM

Planned Begin	Est.	Planned End
0	8	8
Actual Begin	**Numb Rolls**	**Actual End**
0		

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task BB CCPM

Planned Begin	Est.	Planned End
4	8	12
Actual Begin	**Numb Rolls**	**Actual End**
4		

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task CC CCPM

Planned Begin	Est.	Planned End
12	8	20
Actual Begin	**Numb Rolls**	**Actual End**
12		

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Task DD CCPM

Planned Begin	Est.	Planned End
20	8	28
Actual Begin	**Numb Rolls**	**Actual End**
20		

(Roll extra 6 to report early)
(Feed actual End time to Task B)

Advanced Applications
Dealing with Assembly (continued)

Discussion

What was the delivery time for the Traditional Schedule? (about 80 days about 60% of the time but 40% of the time it can be much more).

What was the delivery time for the CCPM Schedule? (about 60 days or less 95% of the time)

What was the difference?

Did the Dice Change?

How often did tasks in the Traditional Schedule report early finishes? (per memory)

How often did tasks in the CCPM schedule report early finishes?

How often did the Feeding Tasks delay the Critical Path in the Traditional Schedule?

How often did the Feeding Tasks delay the Critical Chain in the CCPM Schedule?

Important Note:

For those who really want to learn, it's worth it to play the CCPM Schedule again another time.

Note how often the first and second Feeder Buffers cause the Critical Chain to be longer. Also note how often the third and fourth Feeder Buffers cause the Critical Chain to be longer.

While this advanced simulation is more difficult to do, it illustrates the value of the firmly placed start times for the feeding chains on the CCPM plan. And, it should give you quite a bit of confidence to see that the later Feeding Chains will have lots of protection as the project nears it end. The Safety is right where you need it.

Keep Thinking!

Dr Holt
jholt@wsu.edu