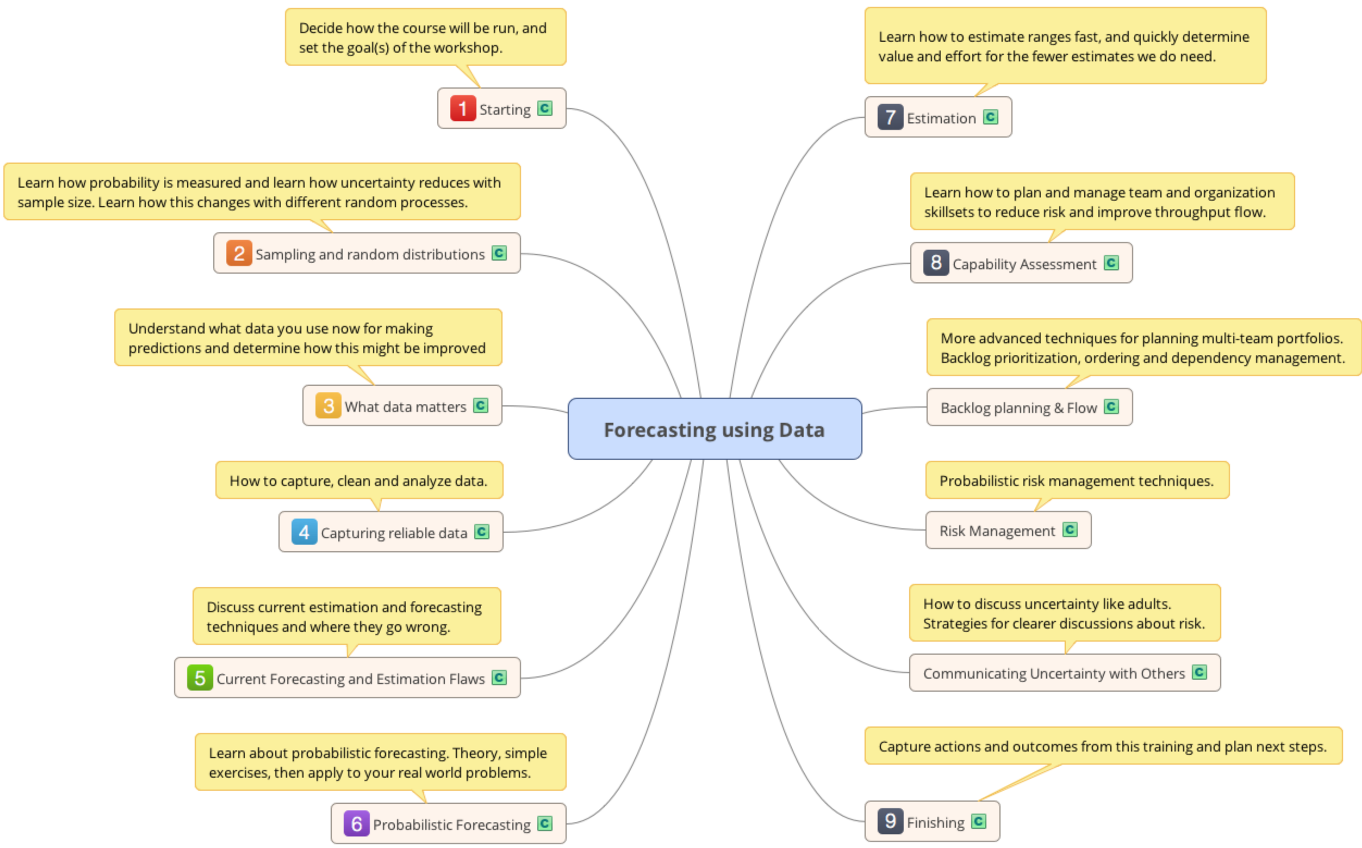
Focused Objective
forecasting - risk - staff - cost of delay

Forecasting using Data

Capturing and using data for forecasting

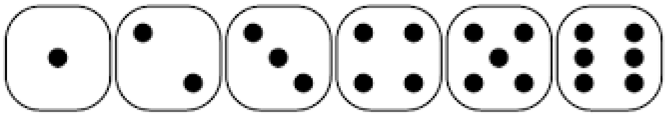


Workshop Manual

Version 2.0

Understanding probability - Exercises

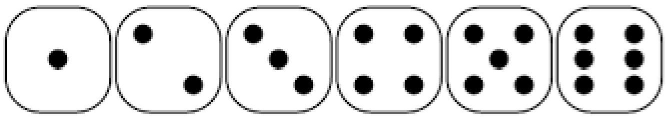
Q1. How many different possible values are there for a standard six-sided dice?



A:

Q2. How many values of a six sided dice are less than 4?

Tip: Circle the values that are less than 4.



A:

Q3. What is the probability of rolling a value less than 4 on a standard six side dice?

Tip: Count the number of “right” values and divide by the total number.

$p = \frac{Number\ of\ "right"\ values}{Total\ possible\ values}$ A:

Q4. What is the probability of rolling at LEAST a 2 on a standard six side dice?

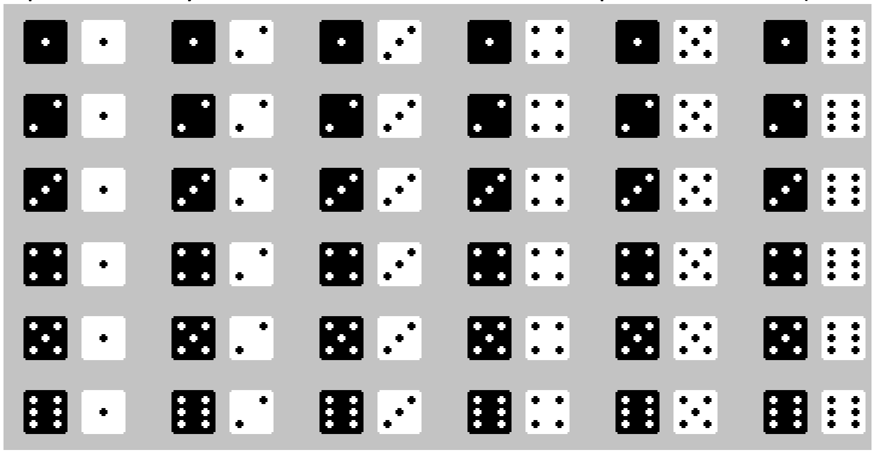
A:

Q5. What is the probability of rolling a value less than 5 on a standard six side dice?

A:

Q6. How many possible outcomes are there for rolling two fair six sided dice?

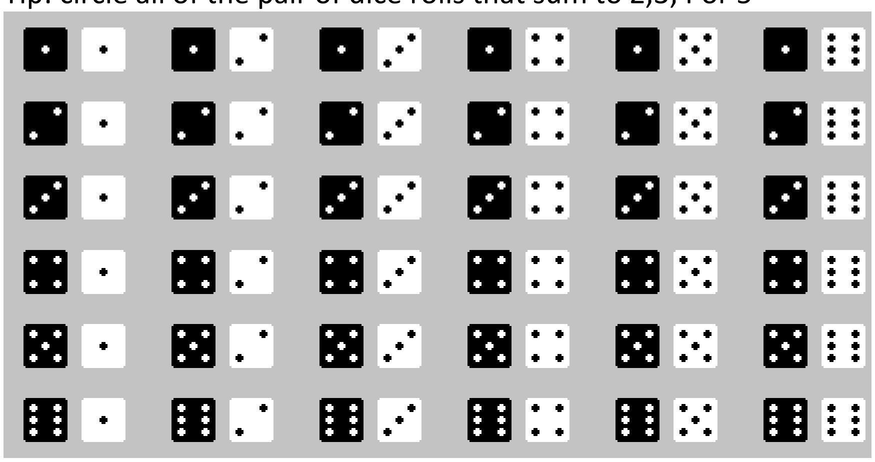
Tip: How many combinations are there in the picture below? (one dice is black, the other white)



A:

Q7. How many values (sum of the two dice) are less than 6?

Tip: circle all of the pair of dice rolls that sum to 2,3,4 or 5



A:

Q8. What is the probability of rolling a combination of less than 6?

Tip: Count the number of "right" values and divide by the total number.

$p = \frac{Number\ of\ \text{correct}\ values}{Total\ possible\ values}$ A:

Answers: Q1: 6 Q2: 3 Q3: 3/6 = 0.5 Q4: 5/6 = 0.83 Q5: 4/6 = 0.67 Q6: 36 Q7: 10 Q8: 10/36 = 0.278

Prediction Intervals Exercise

To find how many samples it takes to find the lower and upper bounds of a sample set on average? This exercise simulates finding the upper and lower boundary of a sequential range by sampling the result of dice rolls.

The process

1. **Roll Dice**: Create a random number with a range of 1 to 100. Options:
    a. A random number generator app on your phone (Randomizers)
    b. Use three rolls of a six-sided dice (see next page for chart)
    c. Sum two 10 sided dice (00 – 90 by 10’s) and a traditional (0-9)
2. **Repeat**: Repeat 20 times and record the results in the table below.
3. **Examine Results**: Look at the range between the lowest rolled and highest rolled. Compare against expected.

3 x 6 Sided Dice

2 x 10 Sided

42

7

99

Note: Rolling a 00 and 0 = 100

Questions and discussion topics

1. **What probability distribution is a single roll?**
2. **What guarantee do I have that I have found the range expected?**
3. **What happens if the data is a Normal (bell curve) distribution?**
4. **What happens if the data is left or right skewed?**

Results table

Record each roll & calculate the ranges seen so far after each roll. Compare to expected.

n prior rolls	This Roll	Lowest So Far	Highest So Far	Range So Far = Highest-Lowest	Expected Range $\frac{(n-1)}{(n+1)} \times 100$
0					
1					0
2					33.3
3					50
4					60
5					66.6
6					71.4
7					75
8					77.8
9					80
10					81.2
11					83.3
12					84.6
13					85.7
14					86.7
15					87.5
16					88.2
17					88.9
18					89.5
19					90

One to One Hundred (1-100) Random Numbers Using Six Sided Dice

First Roll

Second Roll

Third Roll

⚀ OR ⚁

	⚀	⚁	⚂	⚃	⚄	⚅
⚀	1	2	3	4	5	6
⚁	7	8	9	10	11	12
⚂	roll again	13	14	15	16	17
⚃	18	19	20	21	22	23
⚄	24	roll again	25	26	27	28
⚅	29	30	31	32	33	34

⚂ OR ⚃

	⚀	⚁	⚂	⚃	⚄	⚅
⚀	35	36	roll again	37	38	39
⚁	40	41	42	43	44	45
⚂	46	47	48	roll again	49	50
⚃	51	52	53	54	55	56
⚄	57	58	59	60	roll again	61
⚅	62	63	64	65	66	67

⚄ OR ⚅

	⚀	⚁	⚂	⚃	⚄	⚅
⚀	68	69	70	71	72	roll again
⚁	73	74	75	76	77	78
⚂	79	80	81	82	83	84
⚃	roll again	85	86	87	88	89
⚄	90	91	92	93	94	95
⚅	96	roll again	97	98	99	100

Example:

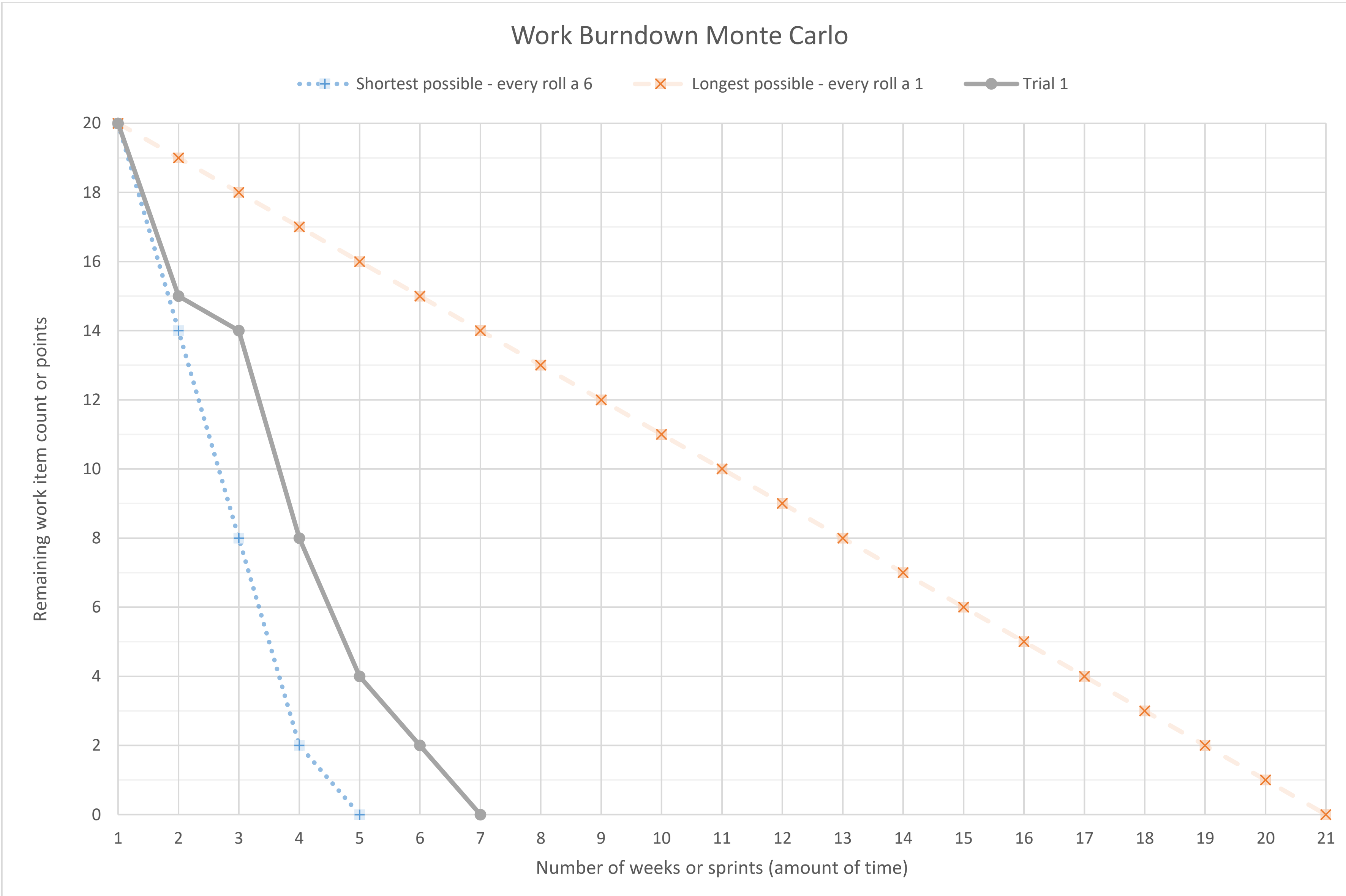
1. Roll three six-sided dice, or one six-sided dice 3 times.
2. Consider: Roll 1 = **3** (table) Roll 2 = **5** (vertical) Roll 3 = **4** (horiz.)
3. The value is at the intersection of

Basic Monte Carlo Forecasting – Manually plot work completion from dice rolls of throughput/velocity (1 to 6)

Discover what Monte Carlo forecasting is by performing it by hand. This exercise simulates completing a project many times and plots the outcomes. Perform 7 more trials. Each trial involves filling all rows in a column until the remaining work count reaches zero.

1. Throw a six-sided dice and subtract the number in the row above by this dice roll.
2. When a column reaches zero (or less, just enter 0), move onto the next trial column.
3. Plot each trial as a line graph on the following page. Trial 1, has already been plotted for you.

Week	**Trial 1 5,1,6,4,2,2**	**Trial 2**	**Trial 3**	**Trial 4**	**Trial 5**	**Trial 6**	**Trial 7**
1 (start)	20	20	20	20	20	20	20
2	-(5) = 15						
3	-(1) = 14						
4	-(6) = 8						
5 (shortest)	-(4) = 4						
6	-(2) = 2						
7	-(2) = 0						
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21 (longest)							


Work Burndown Monte Carlo
Shortest possible - every roll a 6
Longest possible - every roll a 1
Trial 1
Remaining work item count or points
Number of weeks or sprints (amount of time)

Throughput Forecast Monte Carlo – Read First

To estimate the number of stories that will be completed by a team for a six (6) week timespan using historical weekly throughput samples from the same team. To understand the probability of achieving those estimates.

The process

1. **Simulate one possible result**: A single six week throughput result is simulated (called a trial) by summing together six historical one-week throughput samples picked at random.
2. **Repeat**: This simulation process is repeated many times (eleven here, but it can be thousands of repetitions). Each trial represents a "possible" six-week throughput result given the team's historical rate of delivery.
3. **Calculate likelihoods**: The proportion of trials that meet or exceed a given throughput value versus the total number of trials is the likelihood that value is achievable in the future.

Questions and discussion topics

5. **What could pollute the throughput samples (make them a poor predictor of the future)?**
6. **How might you correct for these sample pollution events?**
7. **Why can't we just use the average or median values to forecast the next six weeks?**
8. **If life depended on this forecast, how many stories would you sign-up for?**
9. **How might you choose a likelihood to target in your company?**
10. **How many trials were needed before the actual average (57.75) was included in the range you saw?**
11. **How would you get more definition in the likelihood percentages?**
12. **What does 100% likelihood mean in this case?**
13. **How would you track progress against this forecast?**
14. **What is the impact of not returning the sample each time?**

Why it works

Historical throughput data for teams measures delivery rate for a wide portion of the development system (the wider the better). Team throughput per week accounts for delays; for example waiting time, impediments, staff availability, interruptions and un-recorded work. The impact of these delays is more significant to a forecast than the hands-on time alone. This is a reason developer estimates are unreliable when forecasting projects, they don't account for delays and system dynamics. In a stable system (e.g. the team isn't blown-up), throughput will be a good predictor of future delivery rate even with large item size variability.

Team Throughput Sample Data

Samples represent the number of stories completed per week by the same team taken from an actual project.
Samples: 16,3,10,6,19,11,17,17,15,9,11,8,5,13,5,7,8,6,10,10,8,5,5,7
Count: 24 Sum: 231 Minimum: 3 Median: 8.5 Average: 9.625 Maximum: 19

Resources

Forecasting spreadsheets: https://github.com/FocusedObjective/FocusedObjective.Resources
(these spreadsheets do the process described here thousands of times instantly. This exercise is for learning purposes, don't do it by hand!)

Exercise – Throughput Forecast Monte Carlo Worksheet

Aim: To estimate the number of stories that will be completed by a team for a six (6) week timespan using historical weekly throughput samples for that team. To understand the probability of achieving those estimates.

Process:

1. Shuffle the 24 throughput cards or dice (whichever method you choose)
2. Pick a card at random or throw dice and record sample in the table below
3. Return the card to the deck and reshuffle ("sample with replacement")
4. Repeat until all squares are filled

We randomly sampled trials 4 to 11 for you to save

Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10	Trial 11
			7	11	7	5	17	5	10	16
			19	7	10	5	13	13	5	7
			6	5	5	3	5	16	6	5
			6	19	5	3	5	3	6	3
			5	7	10	5	6	8	8	6
			5	7	19	10	16	8	10	16

5. **Sum of all samples for each trial by column (upper) / Nearest "tens" grouping rounded down (lower)**

			48	**56**	**56**	**31**	**62**	**53**	**45**	**53**
			40+	50+	50+	30+	60+	50+	40+	50+

6. **Probabilities of achieving at least n stories for a six-week timespan**

Six Week Throughput	Count trial sum groups at least 30,40, 50, etc. stories	(Count / 11) Likelihood
At least **30** stories		
At least **40** stories		
At least **50** stories		
At least **60** stories		
At least **70** stories		
At least **80** stories		
At least **90** stories		

This value is 0 to 1 Multiply it by 100 to get a percentage. 0% = no chance, 100% means every trial achieved at least this level.

Samples: Random Samples of Throughput by Six-Sided Dice

To generate random samples from the throughput history, throw two six-sided dice (or throw one six-sided dice twice) and use the sample value at the intersection of the two dice results. It's important to make certain samples are taken at random, and using a dice is often the fairest way to ensure you don't introduce bias!

First dice throw

	⚀	⚁	⚂	⚃	⚄	⚅
⚀	16	3	10	6	19	11
⚁	17	17	15	9	11	8
⚂	5	13	5	7	8	6
⚃	10	10	8	5	5	7
⚄	Roll again	Roll again	Roll again	Roll again	Roll again	Roll again
⚅	Roll again	Roll again	Roll again	Roll again	Roll again	Roll again

Second dice throw

Capture Recapture Exercise 1: **DO NOT START UNTIL ASKED**

Circle the spelling mistakes in the following paragraph.

George new that he shouldn't drink alchohol on a Wedsday night, especially since his govermnet proffesor had schedualed an important exam on Thrusday. However, he beleived he would loose his friends if he didn't go out with them. The pressure to fit in with his peers was worst then the fear of bad grades. To be popular among his friends, one had to be either a musclar athelete or a wild and crazy drinker. George realy could not concieve how it was posible for a student to consume huge quanities of liquor and still suceed in school. Maybe the drinkers were just more briliant than he was. He didn't even enjoy the passtime of spending ours in a bar trying to persue a temperary feeling of excitement and "fun." Somehow he expected the cheif of campus security to catch him and the university administration to expell him. But George didn't posses enough courage to express his opion to his friends. He was certian they would tell him to mind his own buisness. Also, he did't want to be seperated from his friends. So he planed to meet them at a local restaraunt, have a few drinks, leave early, take some asprin, and spend a few ours studing for the exam.

Total mistakes found:

Total mistakes found by both groups:

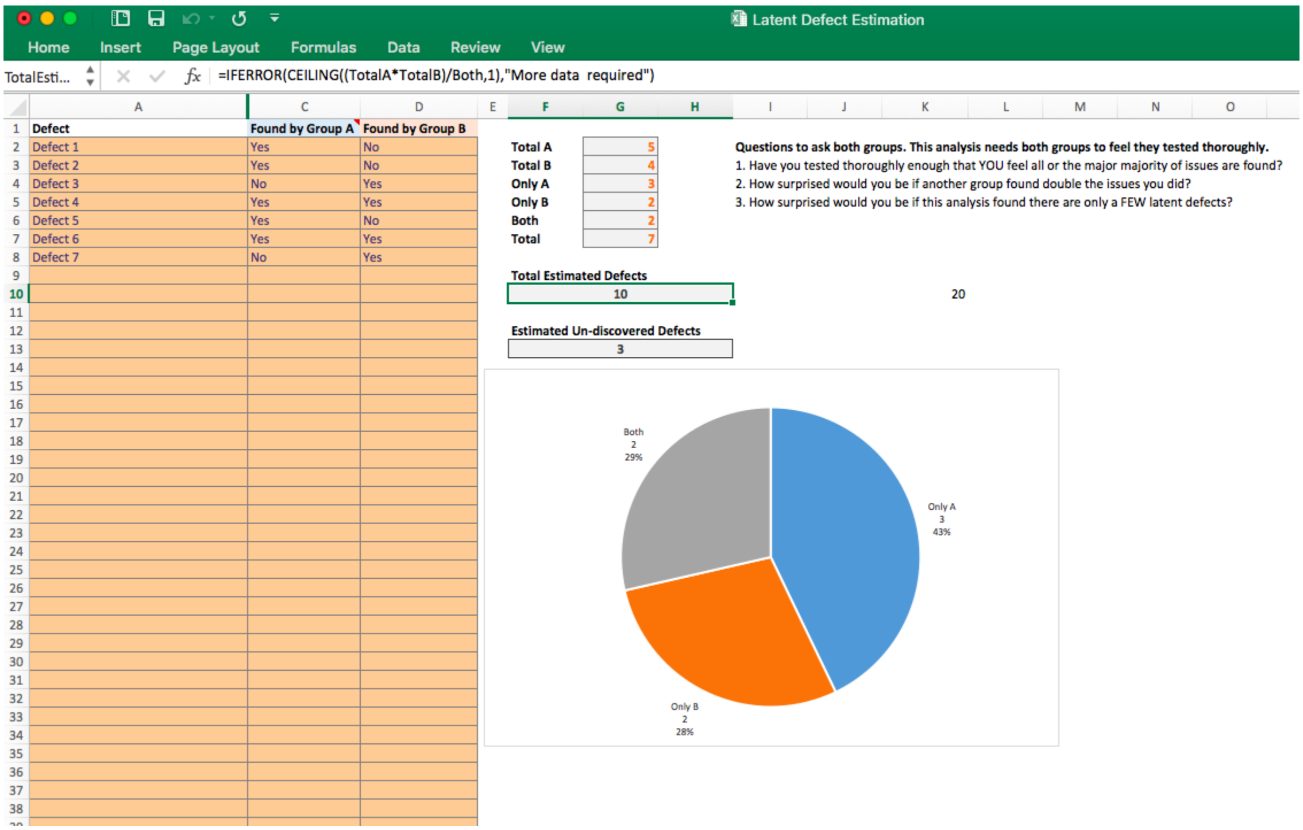
Latent Defect Estimation

Get from: Bit.ly/SimResources – Spreadsheets/Latent Defect Estimation

Use it to estimate the number of defects remaining after two groups independently check,

Discuss –

- How to perform this analysis when beta testing
- How to perform this analysis with bug bash days



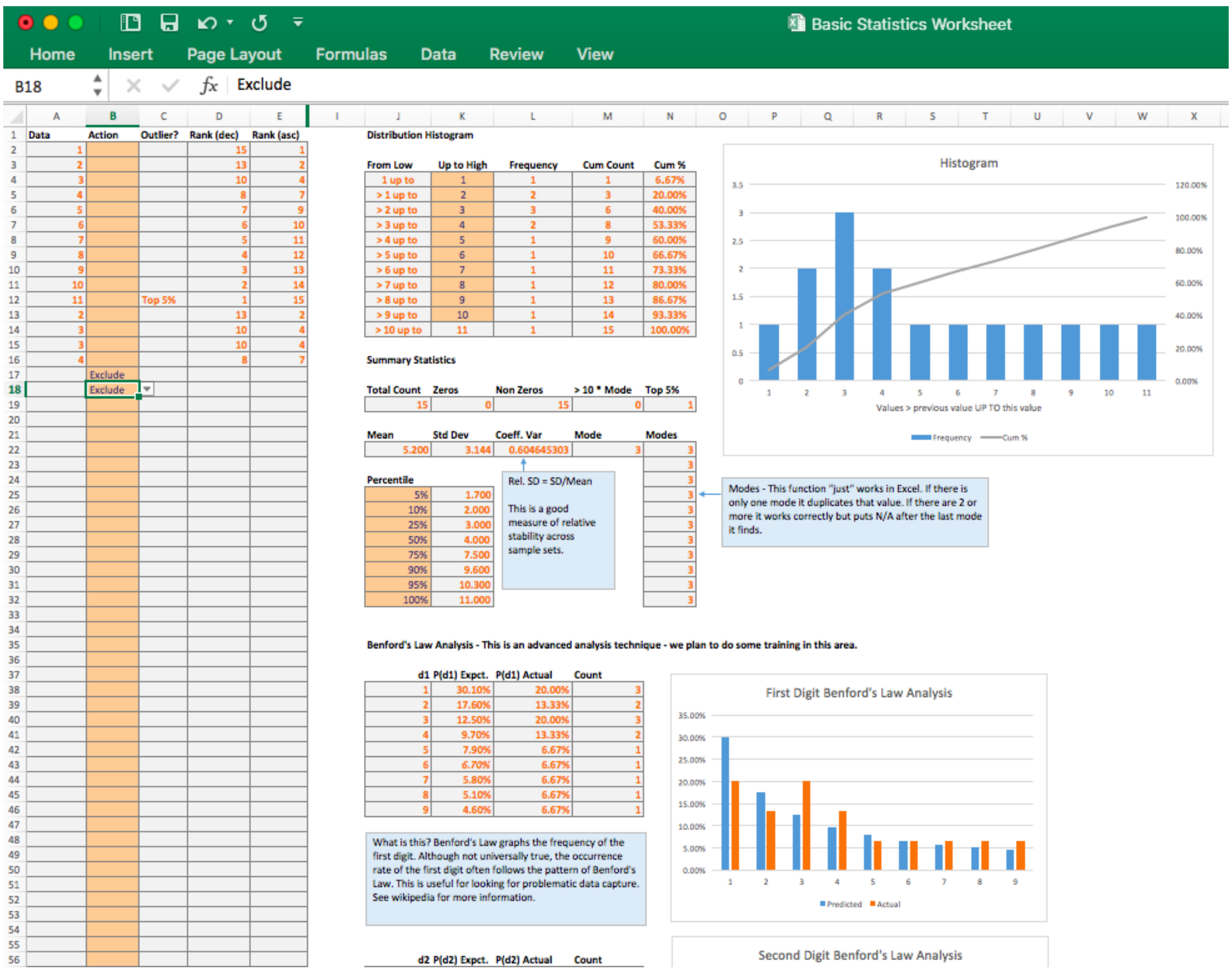
Basic Statistics Worksheet

Get from: Bit.ly/SimResources – Spreadsheets/Basic Statistics Worksheet

Use it to analyze numerical data for consistency, outliers and special cases that might reflect good or bad data quality issues.

Discuss –

- Statistical Terms: mean vs median
- Histograms: Why they are useful
- Outlier Management: What is an outlier, what do you do
- Zero and empty management: How to avoid these causing errors
- Benfords Law: Detecting non-random….



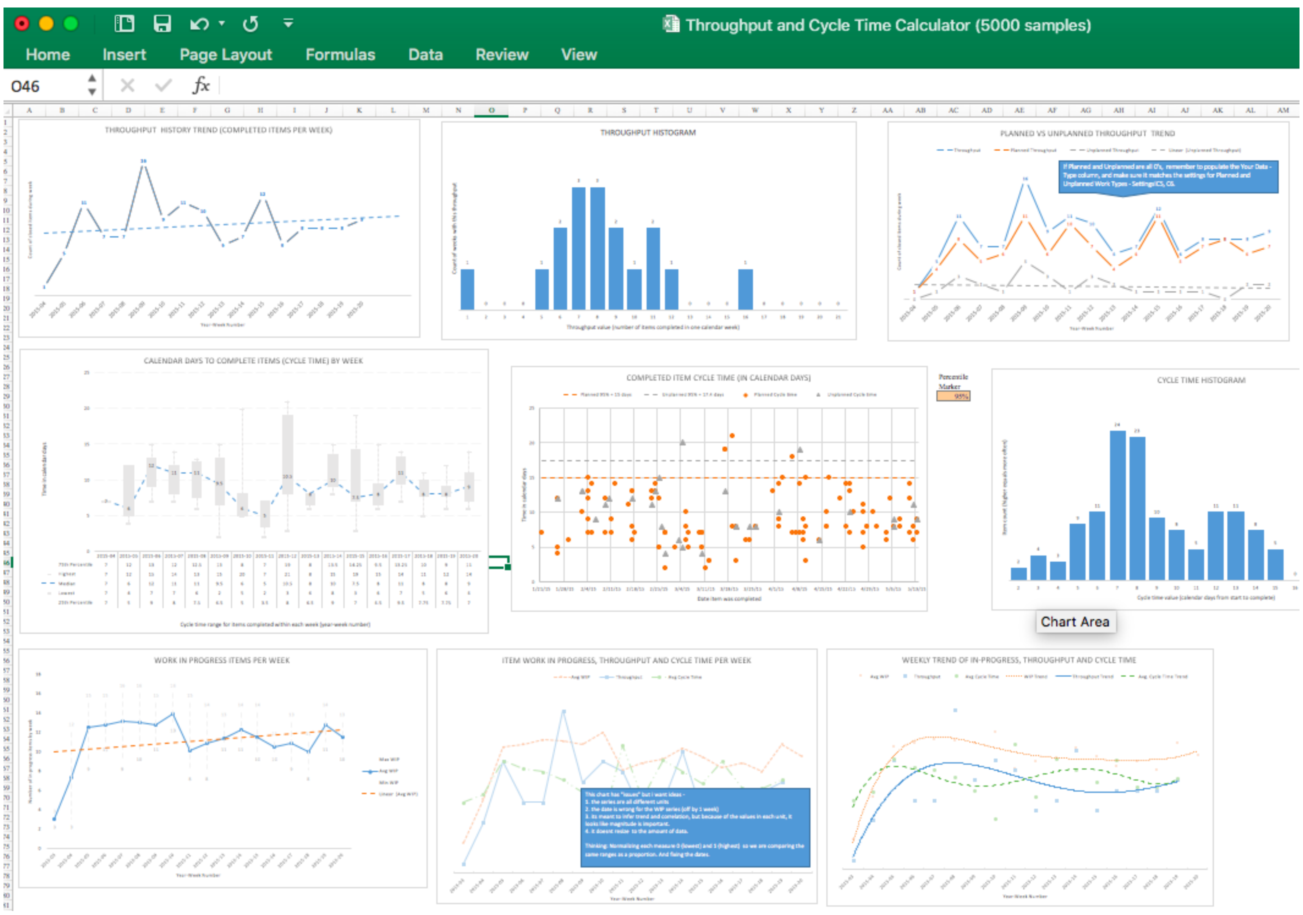
Throughput and Cycle Time Calculator / Team Dashboard

Get from: Bit.ly/SimResources – Spreadsheets/ Throughput and Cycle Time Calculator (5000 samples).xlsx and Spreadsheets/Team Dashbord.xlsx

Use it to analyze story completion and start dates and generate throughput and cycle time. Also produces 17 other charts.

Discuss –

- How to get the date data
- The different charts it produces
- Planned versus un-planned work settings
- Where to copy cycle time and throughput values



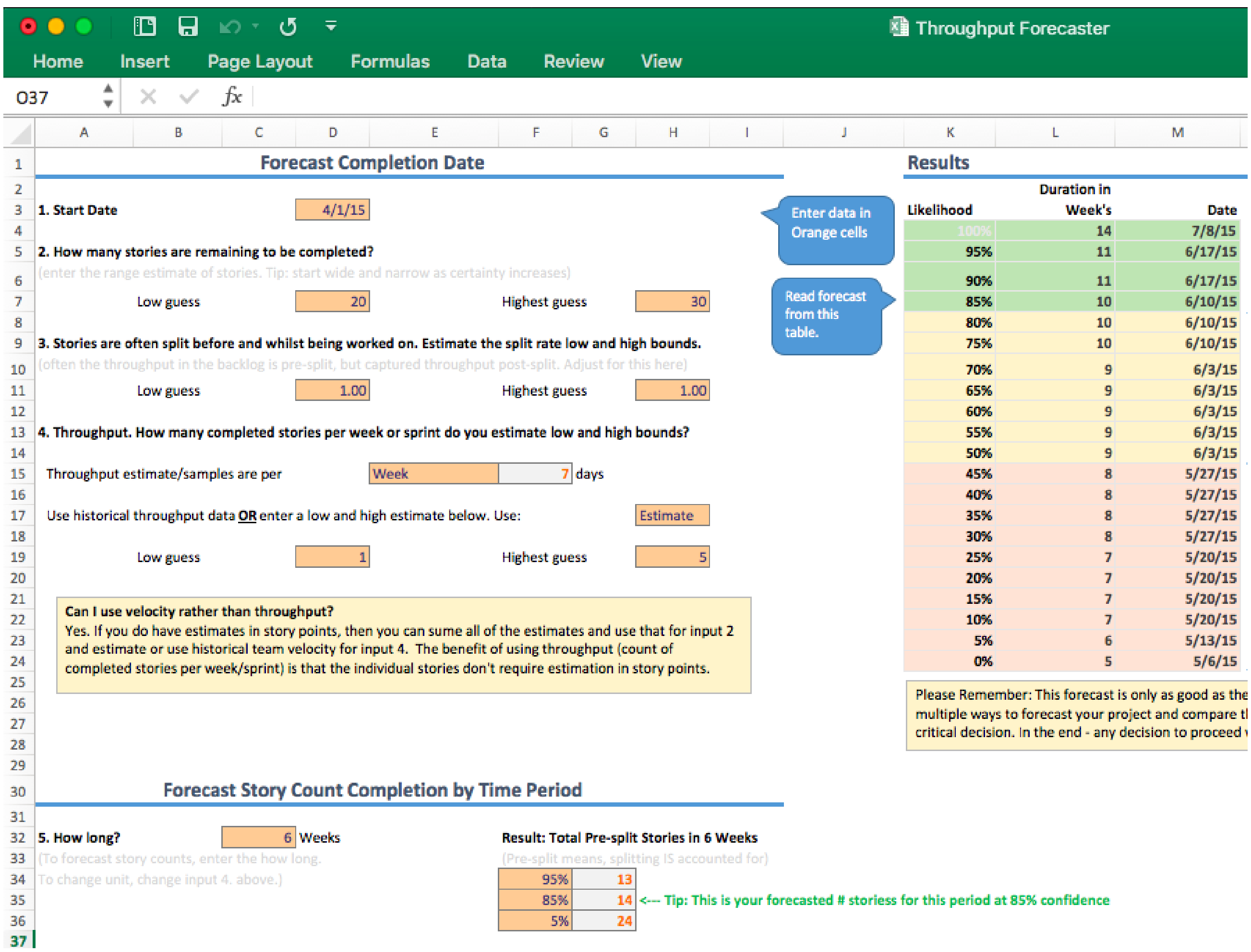
Throughput Forecaster

Get from: Bit.ly/SimResources – Spreadsheets/Throughput Forecaster.xlsx

Use it to forecast a single feature or how much work fits within a fixed time-frame. Can use historical data or range guesses

Discuss –

- The charts and how it works
- How to get the throughput data
- How to perform the range estimates
- How to track actual versus estimates
- Modeling and Forecasting Risks



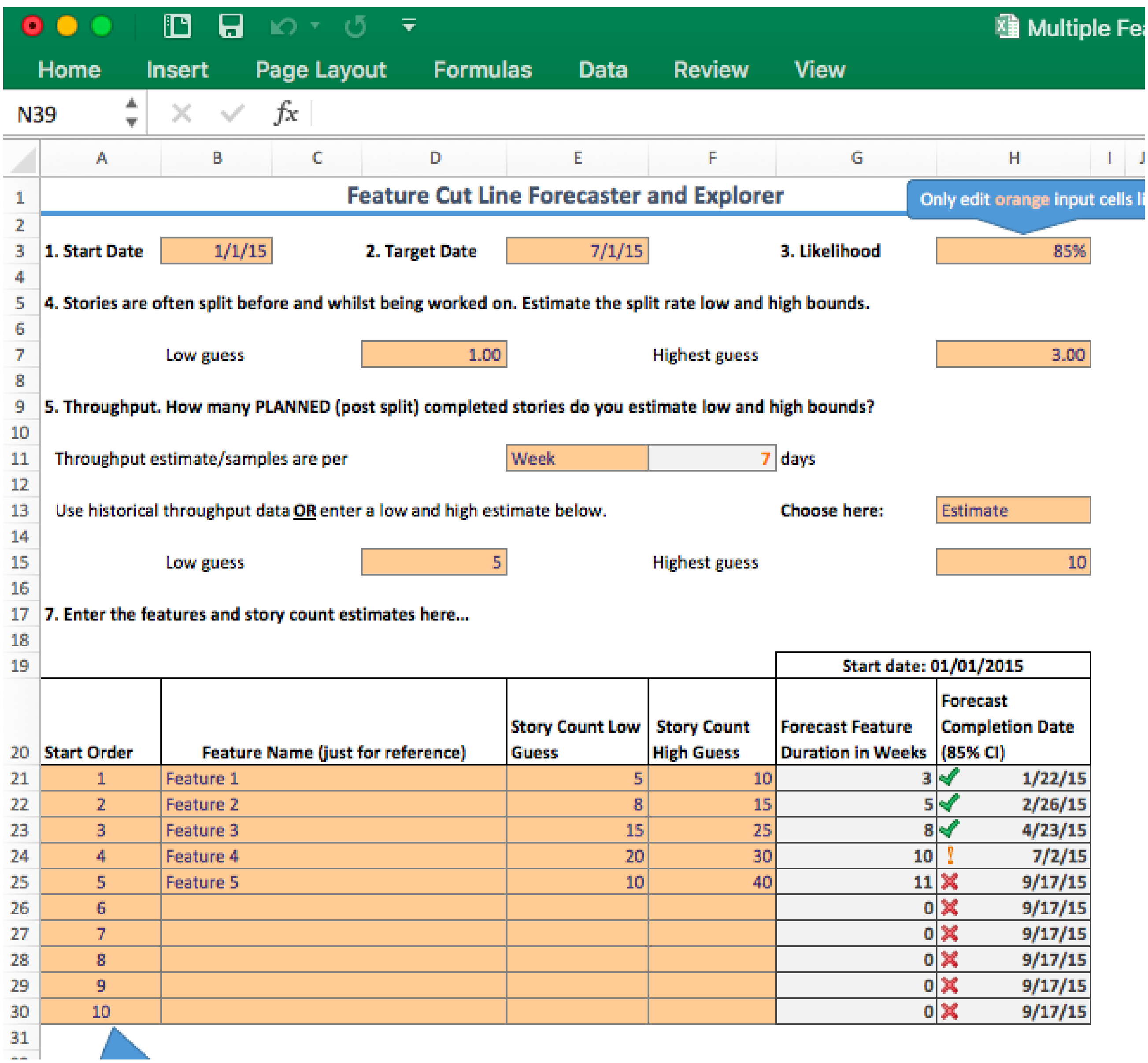
Multiple Cut Line Forecaster

Get from: Bit.ly/SimResources – Spreadsheets/Multiple Feature Cut Line Forecaster.xlsx

Use it to forecast a what features will likely deliver by a target date, and to simulate different start orders of those features to maximize value delivery.

Discuss –

- How to split features
- How to set split rate
- Using estimates before sample data is available
- How to simulate order change
- Why to use month adjustments (vacation, staff increases, conferences, etc)



Feature Cut Line Forecaster and Explorer

1. Start Date: 1/1/15 — 2. Target Date: 7/1/15 — 3. Likelihood: 85%

4. Stories are often split before and whilst being worked on. Estimate the split rate low and high bounds.

Low guess: 1.00 — Highest guess: 3.00

5. Throughput. How many PLANNED (post split) completed stories do you estimate low and high bounds?

Throughput estimate/samples are per: Week — 7 days

Use historical throughput data OR enter a low and high estimate below. Choose here: Estimate

Low guess: 5 — Highest guess: 10

7. Enter the features and story count estimates here...

Start Order	Feature Name (just for reference)	Story Count Low Guess	Story Count High Guess	Forecast Feature Duration in Weeks	Forecast Completion Date (85% CI) — Start date: 01/01/2015
1	Feature 1	5	10	3	1/22/15
2	Feature 2	8	15	5	2/26/15
3	Feature 3	15	25	8	4/23/15
4	Feature 4	20	30	10	! 7/2/15
5	Feature 5	10	40	11	9/17/15
6				0	9/17/15
7				0	9/17/15
8				0	9/17/15
9				0	9/17/15
10				0	9/17/15

Cost of Delay Prioritization Calculator

Get from: Bit.ly/SimResources – Cost of Delay Prioritization Calculator.xlsx

Use it to compute total cost of delay and to find an “optimal” start order for proposed work.

Discuss –

- The different cost of delay ordering techniques (see cheat sheet)
- How to introduce cost of delay
- How complex is too complex
- How to account for dependencies and enablers

Feature or Story Information				Value Inputs		Calculations	Results				
ID	Feature Name	Forecast Remaining Days	Pre-requisite Parent Id	Value	Value Unit	value / day	WSJF Preferred Order	Total COD per Day (inc. children)	WSJF Weight (inc. children)	Total COD per Day (no children)	WSJF Weight (no children)
1	Feature 1	3	4	$ 30,000	Month	$ 1,000.00	4	$ 1,000.00	333.3333	$ 1,000.00	333.3333
2	Feature 2	4		$ 70,000	Month	$ 2,333.33	2	$ 2,333.33	583.3333	$ 2,333.33	583.3333
3	Feature 3	6	4	$ 90,000	Month	$ 3,000.00	3	$ 3,000.00	500.0000	$ 3,000.00	500.0000
4	Refactoring	10		$ -	Day	$ -	1	$ 4,000.00	833.3333	$ -	0.0000
5				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
6				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
7				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
8				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
9				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
10				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
11				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
12				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
13				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
14				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
15				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
16				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
17				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
18				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
19				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
20				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
21				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
22				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
23				$ -	Month	$ -		$ -	0.0000	$ -	0.0000
24				$ -	Month	$ -		$ -	0.0000	$ -	0.0000

Cost of Delay | WSJF Prioritization (simple) | **WSJF Prioritization (moderate)** | WSJF Prioritization (complex) | Setup | Example

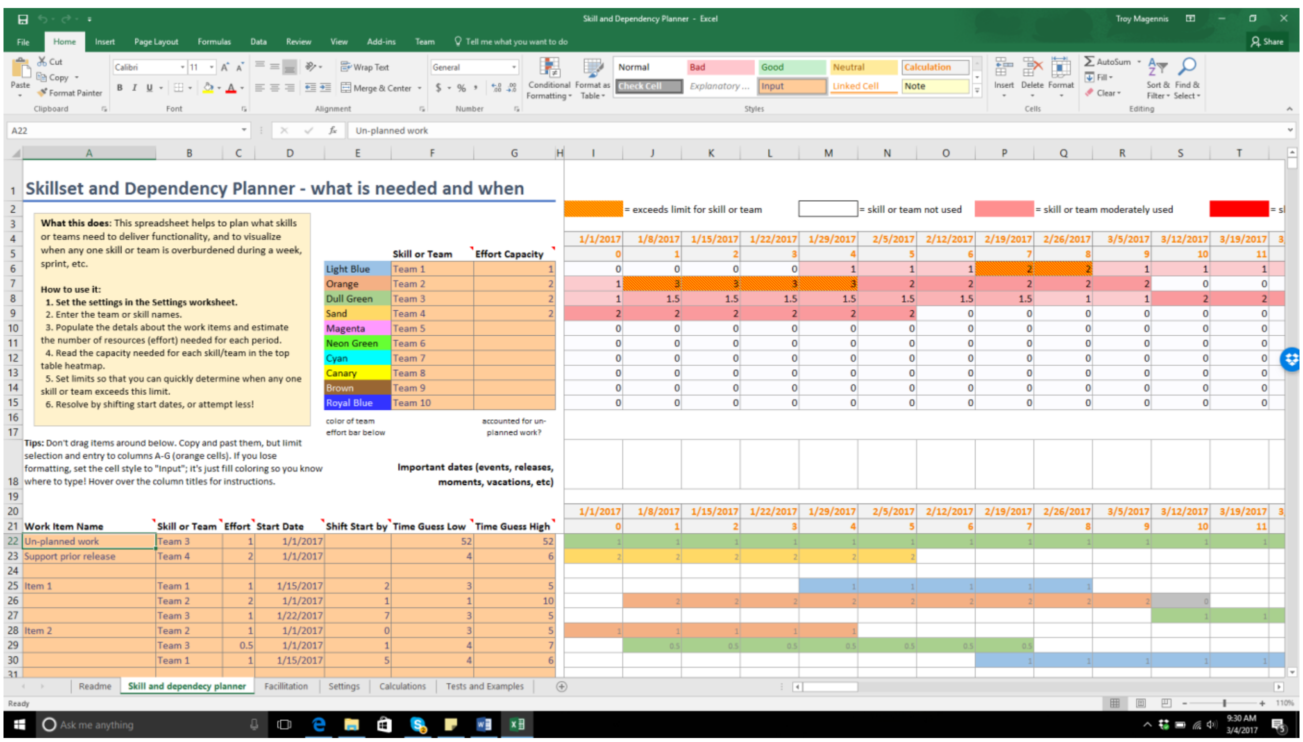
Skill and Dependency Portfolio Planner – make dependencies visible, determine constraints and finding optimal start dates

Get from: Bit.ly/SimResources – Spreadsheets/Skill and Dependency Planner.xlsx

Use it to understand team or skill utilization in portfolio and dependency planning. Find ways to balance capacity by shifting start dates. Visually represent the load on teams for discussion and constraint analysis.

Discuss –

- How to find the constraint during planning
- What to do when a constraint is hit
- How to enter data in a group facilitation environment
- How to reserve capacity and set realistic limits



Quarterly Portfolio Planning - one item at a time until you exceed capacity

The scene:

A group of product owners and stakeholders meet at regular intervals to plan an upcoming period of time. Everyone brings their laundry list of ideas to a full day meeting to plan what will get done. Normally, there are thousands of times more ideas than capacity, and even the MUST HAVES would take the next 12 months to complete.

The goal:

To ensure that the most important items (highest cost of being delayed) make it into the next quarter. To make sure that no one team or skillset is burdened with more than it has achieved historically.

Suggested process:

1. Debrief last quarters plans. Identify carry over work. Identify how well the last plan played out with respect to keeping teams within their effort budget. No blame, just looking to learn how to set correct capacity limits and what type of work we plan poorly.
2. Reserve capacity for teams and skills.
    - To account for warranty of prior released features
    - To account for any team un-planned work in addition to this plan
3. Identify key dates. Are any dates immovable, for example a consumer promotional campaign, sporting event, or conference. List these dates and decide when work will need to be "finished" to allow other activities to take place (for example, training guides or website updates based on the new features or products.
4. Identify the total capacity limit for each team or skill. Decide what units make sense here. It can be people, it can be throughput, it can be story points. Just decide upfront and be consistent with this limit and the effort estimate for each line item.
5. Have the group identify THE ABSOLUTE ONE FEATURE that must deliver. It MUST be one single highest priority.
6. Brainstorm what teams or skills are needed to deliver this ONE feature. Enter this into this spreadsheet and break out one row per team or skill involved, have someone from each team perform a quick estimate of lowest and highest delivery time and effort estimates (these are broad 1 week or 2 week estimates, NOT detailed estimates. Allow the team the final say on these estimates, don't second guess them.
7. Once all of the dates and effort estimates are entered, look at the team and skill heatmap. Have any of the skills hit their limit yet?
    - No: Go back to step 5 and repeat for the net feature
    - Yes: Can you move the start date of this feature to reduce peak demand, for example can you move the start date later to avoid overwhelming the exceeded skill or team? If NOT then that’s it. You have your plan.
8. Still have some teams lightly loaded? Can they help teams that are overwhelmed and get the next highest priority feature? Rule this out before loading them with "Nice to have work."

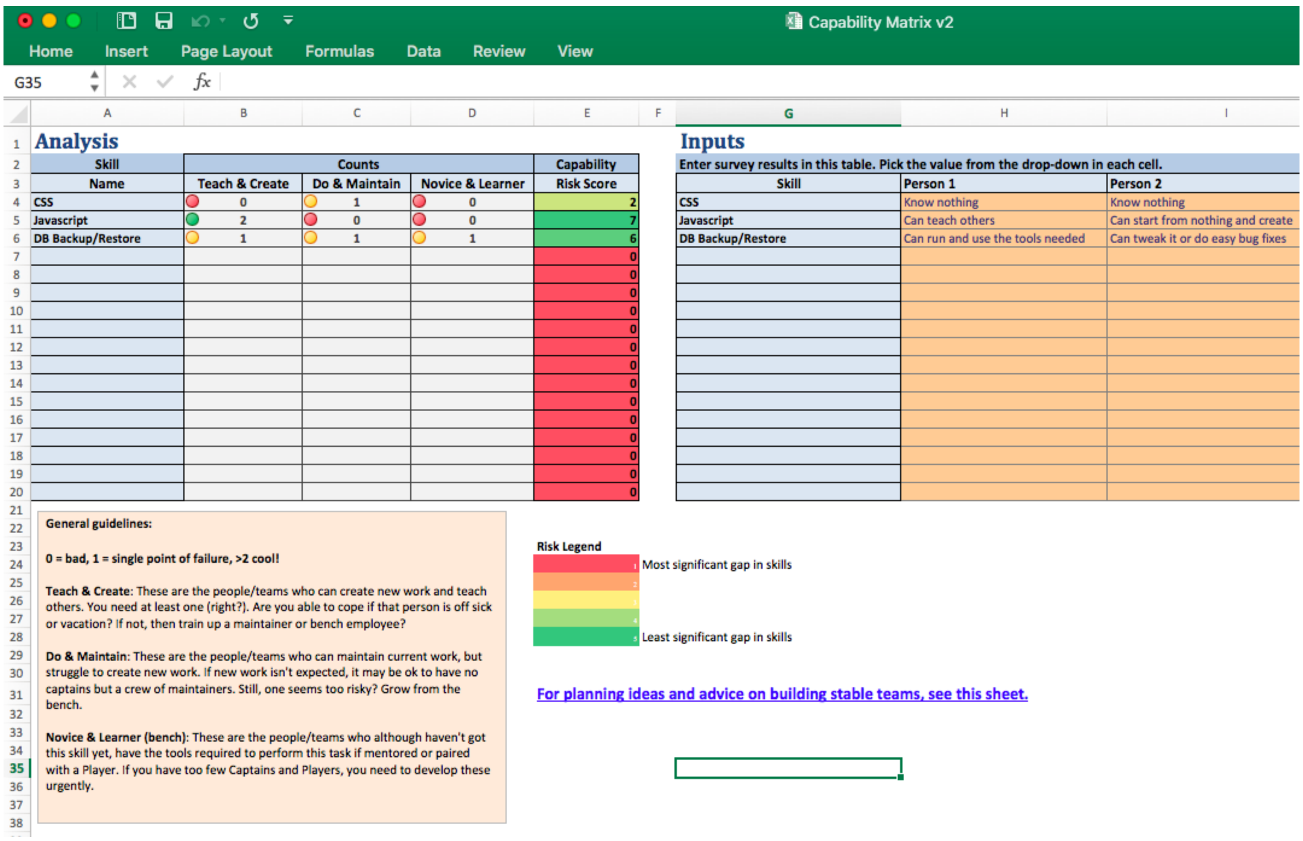
Capability Matrix v2

Get from: Bit.ly/SimResources – Spreadsheets/Capability Matrix v2.xlsx

Use it to quickly survey for available skills and understand who can teach those skills.

Discuss –

- How to decide what skills to survey
- How to maximize honest answers
- How to plan team growth and splitting points



Kingman’s Formula – utilization and variation on cycle time

Get from: Bit.ly/SimResources – Spreadsheets/Kingmans Formula.xlsx

Use it to teach and understand how utilization and variation can impact cycle-time.

Discuss –

- Double the mean service time. What happens to wait time?
- Set the service time variation to 0, play with service time variation. Double and halve
- Which variability matters more, arrival rate or service time?

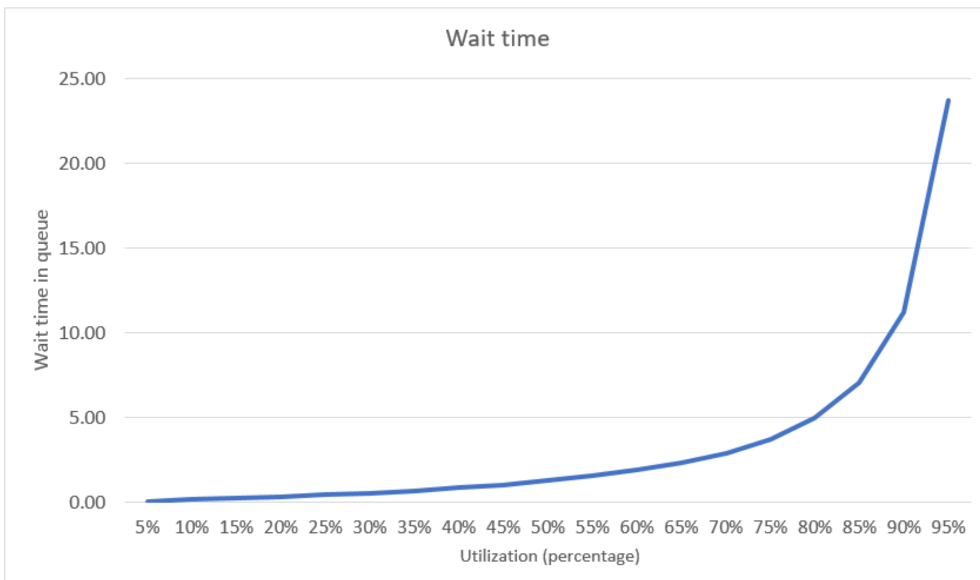
Kingman's Approximation

Calculations on the distributions:

mean service time	5	any time unit, minutes, hours, days, weeks, etc.
arrival time variation	0.500	higher is more variation. This is the SD/Mean of arrival rates. Start with 0.1-1.0 to experiment.
service time variation	0.500	higher is more variation. This is the SD/mean of service times. Start with 0.1 to 1 to experiment.

Results

Utilization	**Wait time**
5%	0.07
10%	0.14
15%	0.22
20%	0.31
25%	0.42
30%	0.54
35%	0.67
40%	0.83
45%	1.02
50%	1.25
55%	1.53
60%	1.88
65%	2.32
70%	2.92
75%	3.75
80%	5.00
85%	7.08
90%	11.25
95%	23.75



Kingman's approximation states

$$\mathbb{E}(W_q) \approx \left(\frac{\rho}{1-\rho}\right)\left(\frac{c_a^2 + c_s^2}{2}\right)\tau$$

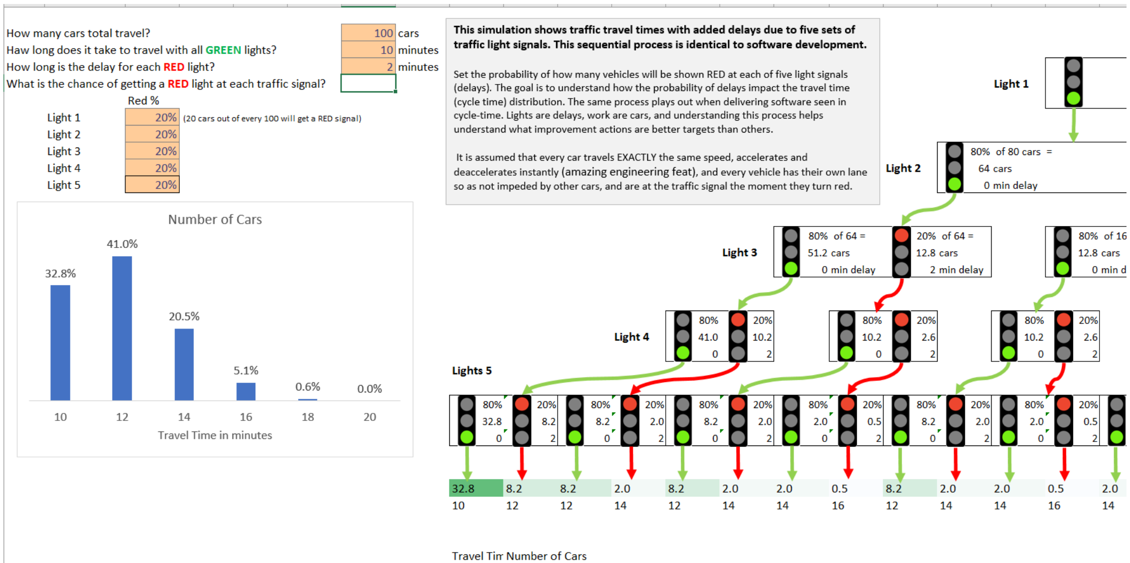
Traffic Light Simulator -

Get from: Bit.ly/SimResources – Traffic Light Simulator.xlsx

Use it teach how delays cause different impacts on cycle time. Learn how to determine what factors influence extremely long cycle times and how this changes what coaching advice will be successful.

Discuss –

- The two basic cycle time distributions
- Find ways to create the different cycle time distributions

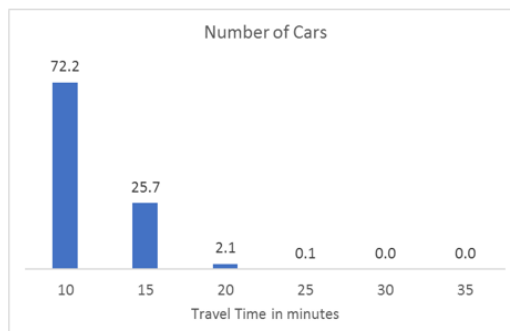


1. **Generating an Exponential Distribution**

Set the inputs values to form an Exponential delay, something like the plot shown to the right.

Tips:

1. This type of distribution is generally because there is MORE chance that items will not be impeded than impeded.
2. There are multiple ways to do this. Try removing all delays (set them to 0%) and adding them one at a time.
3. Alter the delay time and see what it does to the shape of time distribution versus the x-axis scale.

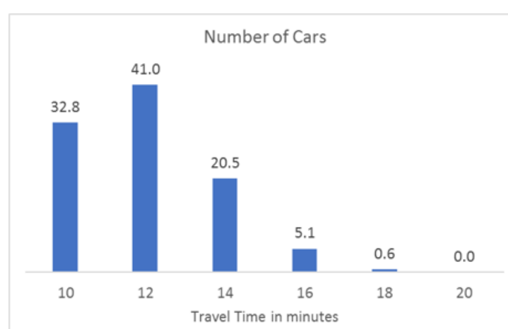


2. **Generating an Weibull/Rayleigh Distribution**

Set the inputs values to form right-skewed distribution, something like the plot shown to the right.

Tips:

1. This type of distribution is generally because its MORE likely than not that at least ONE delay will be encountered by every car.
2. There are multiple ways to do this. Try setting all delays to the same probability > 10% and increase them until you start to see skewing occur.



Capture-Recapture Exercise Answers:

George new that he shouldn't drink alchohol on a Wedsday night, especially since his govermnet proffesor had schedualed an important exam on Thrusday. However, he beleived he would loose his friends if he didn't go out with them. The pressure to fit in with his peers was worst then the fear of bad grades. To be popular among his friends, one had to be either a musclar athelete or a wild and crazy drinker. George realy could not concieve how it was posible for a student to consume huge quanities of liquor and still suceed in school. Maybe the drinkers were just more briliant than he was. He didn't even enjoy the passtime of spending ours in a bar trying to persue a temperary feeling of excitement and "fun." Somehow he expected the cheif of campus security to catch him and the university administration to expell him. But George didn't posses enough courage to express his opion to his friends. He was certian they would tell him to mind his own buisness. Also, he did't want to be seperated from his friends. So he planed to meet them at a local restaraunt, have a few drinks, leave early, take some asprin, and spend a few ours studing for the exam.

Corrected -

George knew that he shouldn't drink alcohol on a Wednesday night, especially since his government professor had scheduled an important exam on Thursday. However, he believed he would lose his friends if he didn't go out with them. The pressure to fit in with his peers was worse than the fear of bad grades. To be popular among his friends, one had to be either a muscular athlete or a wild and crazy drinker. George really could not conceive how it was possible for a student to consume huge quantities of liquor and still succeed in school. Maybe the drinkers were just more brilliant than he was. He didn't even enjoy the pastime of spending hours in a bar trying to pursue a temporary feeling of excitement and "fun." Somehow he expected the chief of campus security to catch him and the university administration to expel him. But George didn't possess enough courage to express his opinion to his friends. He was certain they would tell him to mind his own business. Also, he didn't want to be separated from his friends. So he planned to meet them at a local restaurant, have a few drinks, leave early, take some aspirin, and spend a few hours studying for the exam.

Total errors: 36

Source: **STUDENT LEARNING ASSISTANCE CENTER (SLAC).** Texas State University-San Marcos

20 COGNITIVE BIASES THAT SCREW UP YOUR DECISIONS

1. Anchoring bias.

People are **over-reliant** on the first piece of information they hear. In a salary negotiation, whoever makes the first offer establishes a range of reasonable possibilities in each person's mind.

2. Availability heuristic.

People **overestimate the importance** of information that is available to them. A person might argue that smoking is not unhealthy because they know someone who lived to 100 and smoked three packs a day.

3. Bandwagon effect.

The probability of one person adopting a belief increases based on the number of people who hold that belief. This is a powerful form of **groupthink** and is reason why meetings are often unproductive.

4. Blind-spot bias.

Failing to recognize your own cognitive biases is a bias in itself. People notice cognitive and motivational biases much more in others than in themselves.

5. Choice-supportive bias.

When you choose something, you tend to feel positive about it, even if that **choice has flaws**. Like how you think your dog is awesome — even if it bites people every once in a while.

6. Clustering illusion.

This is the tendency to **see patterns in random events**. It is key to various gambling fallacies, like the idea that red is more or less likely to turn up on a roulette table after a string of reds.

7. Confirmation bias.

We tend to listen only to information that confirms our **preconceptions** — one of the many reasons it's so hard to have an intelligent conversation about climate change.

8. Conservatism bias.

Where people favor prior evidence over new evidence or information that has emerged. People were **slow to accept** that the Earth was round because they maintained their earlier understanding that the planet was flat.

9. Information bias.

The tendency to **seek information when it does not affect action**. More information is not always better. With less information, people can often make more accurate predictions.

10. Ostrich effect.

The decision to **ignore dangerous or negative information** by "burying" one's head in the sand, like an ostrich. Research suggests that investors check the value of their holdings significantly less often during bad markets.

11. Outcome bias.

Judging a decision based on the **outcome** — rather than how exactly the decision was made in the moment. Just because you won a lot in Vegas doesn't mean gambling your money was a smart decision.

12. Overconfidence.

Some of us are **too confident about our abilities**, and this causes us to take greater risks in our daily lives. Experts are more prone to this bias than laypeople, since they are more convinced that they are right.

13. Placebo effect.

When **simply believing** that something will have a certain effect on you causes it to have that effect. In medicine, people given fake pills often experience the same physiological effects as people given the real thing.

14. Pro-innovation bias.

When a proponent of an innovation tends to **overvalue its usefulness** and undervalue its limitations. Sound familiar, Silicon Valley?

15. Recency.

The tendency to weigh the **latest information** more heavily than older data. Investors often think the market will always look the way it looks today and make unwise decisions.

16. Salience.

Our tendency to focus on the **most easily recognizable features** of a person or concept. When you think about dying, you might worry about being mauled by a lion, as opposed to what is statistically more likely, like dying in a car accident.

17. Selective perception.

Allowing our expectations to **influence how we perceive** the world. An experiment involving a football game between students from two universities showed that one team saw the opposing team commit more infractions.

18. Stereotyping.

Expecting a group or person to have certain qualities without having real information about the person. It allows us to quickly identify strangers as friends or enemies, but people tend to **overuse and abuse** it.

19. Survivorship bias.

An error that comes from focusing only on surviving examples, causing us to **misjudge a situation**. For instance, we might think that being an entrepreneur is easy because we haven't heard of all those who failed.

20. Zero-risk bias.

Sociologists have found that **we love certainty** — even if it's counterproductive. Eliminating risk entirely means there is no chance of harm being caused.

SOURCES: Brain Biases; Ethics Unwrapped; Explorable; Harvard Magazine; HowStuffWorks; LearnVest; Outcome bias in decision evaluation, Journal of Personality and Social Psychology; Psychology Today; The Bias Blind Spot: Perceptions of Bias in Self Versus Others, Personality and Social Psychology Bulletin; The Cognitive Effects of Mass Communication, Theory and Research in Mass Communications; The less-is-more effect: Predictions and tests, Judgment and Decision Making; The New York Times; The Wall Street Journal; Wikipedia; You Are Not So Smart; ZhurnalyWiki

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