Learning Report

Things I have learned while trying to solve the 'Trey Klein' puzzle.

Overview

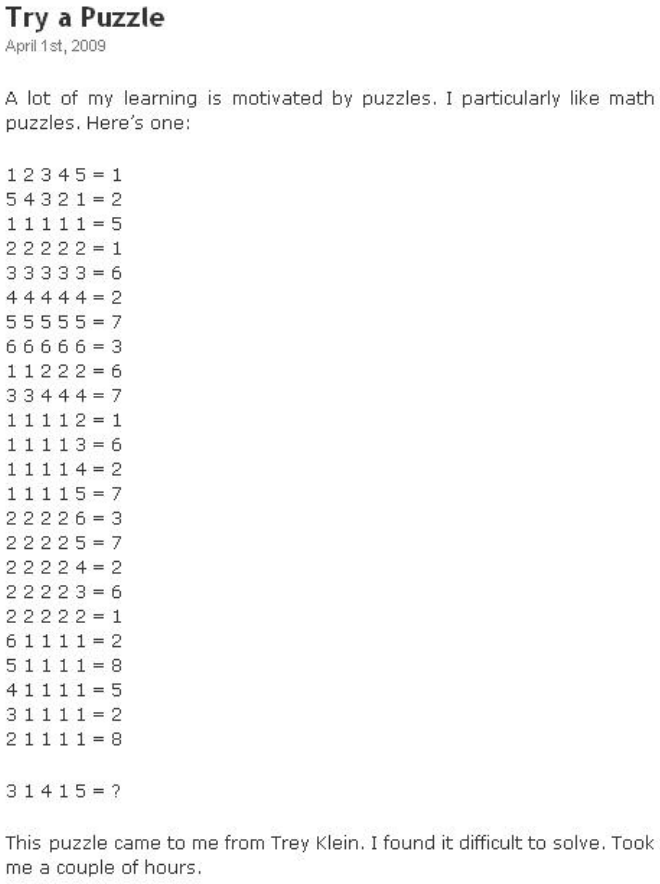
On April 5, 2009 I have read James Bach's latest entry on his Buccaneer blog (http://www.buccaneerscholar.com/blog/). This entry is titled 'Try a Puzzle'.

The puzzle is presented as a math puzzle, and I am motivated to explore to find a solution.

This learning report contains the details of my exploration, including journal entries, lists of tasks, ideas, questions, and most important a high level overview of things that I have learned along the way.

I have stored all previous versions of this report and I plan to use it in my classes on Software testing.

A screenshot of the initial section of the problem as listed on the blog is displayed below.



Try a Puzzle

April 1st, 2009

A lot of my learning is motivated by puzzles. I particularly like math puzzles. Here's one:

```
1 2 3 4 5 = 1
5 4 3 2 1 = 2
1 1 1 1 1 = 5
2 2 2 2 2 = 1
3 3 3 3 3 = 6
4 4 4 4 4 = 2
5 5 5 5 5 = 7
6 6 6 6 6 = 3
1 1 2 2 2 = 6
3 3 4 4 4 = 7
1 1 1 1 2 = 1
1 1 1 1 3 = 6
1 1 1 1 4 = 2
1 1 1 1 5 = 7
2 2 2 2 6 = 3
2 2 2 2 5 = 7
2 2 2 2 4 = 2
2 2 2 2 3 = 6
2 2 2 2 2 = 1
6 1 1 1 1 = 2
5 1 1 1 1 = 8
4 1 1 1 1 = 5
3 1 1 1 1 = 2
2 1 1 1 1 = 8

3 1 4 1 5 = ?
```

This puzzle came to me from Trey Klein. I found it difficult to solve. Took me a couple of hours.

Mind notes & Journal entries

(Things that came to mind when working with this puzzle)

[Journal Entry – April 06, 2009]

- 1-minute view at the puzzle (as presented in the blog entry). This 1 minute view is to get an initial assessment to see if I notice some obvious patterns.
- No obvious patterns detected. STOP.
- Take a higher level view to see if anything draws my attention.

Observations

- OBS_01: There seem to be a lot of '1' (compared to other numbers). Task_01: Observation to be verified.
- OBS_02: There seem to be a lot of '2' (compared to other numbers). Task_02: Observation to be verified.
- OBS_03: There are no '0's.
- OBS_04: The results are not greater than 8. Could be misleading to call this 'results'. Task_03: organize a variables grid to facilitate communication with other people (and for myself)
- OBS_05: There are no terms/factors greater than 6. Task_04: organize a variables grid to facilitate communication with other people (and for myself)
- OBS_06: There are 24 rows with information. Question_01: why 24 while there are far less terms/factors? (this is weird)
- OBS_07: There are 2 identical rows. Question_02: would the sequence of rows have any impact?
- OBS_08: The fact that all symbols are math symbols (except for the '?') makes me think that this is a math puzzle. Task_05: Verify that this is an assumption or that the blog actually states that this is a math puzzle.
- To verify OBS_01 and OBS_02 I copied the entries in excel and counted the occurrences for each number. This confirmed my observation.
- To verify if the sequence had any impact I sorted the complete table for each column. Nothing special seems to surface when keeping one value fixed.
- Question_03: Would the calculation be based on columns info, rather than on row info? Question_04: Does the '=' sign really mean the mathematical '='?

[Journal Entry – April 7, 2009]

- I usually send my eMail replies to james@satisfice.com. This reply I wanted to send to his buccaneer eMail address. To get the correct buccaneer eMail I went to the Buccaneer website (not the blog). Once the website appeared, the first thing that I noticed was the abbreviated entry for the Trey Klein puzzle. Idea_01: Seeing the display below, triggered the idea to put the entries in a string instead of multiple rows.

Try a Puzzle
A lot of my learning is motivated by puzzles. I particularly like math puzzles. Here's one: 1 2 3 4 5 = 1 5 4 3 2 1 = 2 1 1 1 1 = 5 2 2 2 2 2 = 1 3 3 3 3 3 = 6 4 4 4 4 4 = 2 5 5 5 5 5 = 7 6 6 6 6 6 = 3 1 1 2 2 2 = 6 3 3 4 4 4 = 7 1 1 1 1 2 = 1 1 1 1 1 3 = 6 1 1 1 1 4 = 2 1 1 1 1 5 = 7 2 2 2 2 6 = 3 2 2 2 2 5 = 7 2 2 2 2 4 = 2 2 2 2 2 3 = 6 2 2 2 2 2 = 1 6 1 1 1 1 = 2 5 1 1 1 1 = 8 4 1 1 1 1 = 5 3 1 1 1 1 = 2 2 1 1 1 1 = 8 3 1 4 1 5 = ? This puzzle came to me from Trey Klein. I found it difficult to solve. Took me a couple of hours. Most buccaneers, I will hazard to say, enjoy the challenge of a good puzzle. If you, like me, can't resist puzzles, [...]

Wed, 01 Apr 2009 06:01:29 +0000

- BREAK … this is as far as I got within the first effort while interacting with the system.
- On my 65 mile drive home I got some new ideas. Idea_02: each number may represent a color code. Idea_03: This looks like NBA standings. Idea_04: What about the ASCII value for each number.
- The next day on my drive to work I thought my notes and feedback need to be more structured. This looks like this will be a more extensive effort, and providing (daily?) feedback to James through eMail will result in chaos after a while. I decide to copy my feedback into a word document, and keep a running version of the facts.
- As I start to paste my eMail feedback into the word document, I decide to create separate sections by grouping ideas, tasks, references, …
- For the purpose of this exercise I also decide to have a separate section with things that I have learned that are not directly related to the puzzle itself (example: the conditional formatting feature in MS Excel).
- As this document seems to be growing fast, I see this evolve into a report that James can publish on his website. This is almost similar to the cheese grater report.
- I decide to apply version control to this document. From a teaching perspective it may be interesting to see how this evolves over time.
- Quest_05: What is the real objective of this exercise? The verbiage in the blog indicates that there is a learning objective while trying to solve the listed puzzle. I am sure that many puzzlers are thinking that the puzzle is solved when you find the numeric value for '?'. I am not so sure that this is a correct assumption.

[Journal Entry: April 8, 2009]

- During the rest of the previous day I didn't have much time to explore.
- Later at night, I just looked at the puzzle for many minutes. Absolutely nothing came to mind. I asked my wife Nathalie if she could have a look at it. Nathalie really doesn't like these kinds of puzzles, but she did have a look because she is very competitive. She was driven by the fact that she might beat the 'braniacs'. Nathalie didn't see anything either, but it was worth a try.
- In the morning (April 8) I am on my 65 mile drive to work again. I feel like I am stuck with the puzzle and I am considering to ask James for a clue once I get at work. However, very quickly ideas pop-up in my mind. I may start to refer to my car as my 'think-tank'. The following ideas come to mind and I'll explore them before I ask for any clues.
- Idea_05: replace every number by its Roman numeral.
- Idea_06: Maybe the numbers are part of a UPC barcode.

- Idea_07: Who is Trey Klein? Knowing more about this person may reveal some clues. Let's google Trey Klein.
- Idea_08: If every digit in the first 5 columns is limited to values between 1 and 6, then there are 7776 different combinations. The puzzle only shows 24 combinations (1 with the '?', 24 other combinations, 1 duplicate for '2 2 2 2 2 = 1'). So what about the 7752 remaining combinations?
- During my lunch break at the office I start to Google for UPC Barcodes. I found interesting information on http://www.howstuffworks.com/ . This site explains that a UPC code is a combination of a 6-digit manufacturer identification number, a 5-digit product code, and a check digit. I also learn that there is a calculation method for the check digit. I apply the calculation method to the 5 digit number. This does not get me closer to a solution for the puzzle. Where would I get the 6 digit manufacturer code? I have tried to find the manufacturer's code for the company that Trey Klein is working for. This does not get me any closer to the solution for the puzzle.
- Even though I did not get any closer to a solution I am extremely excited that I have learned how UPC barcodes work. This really got me energized to work more on the puzzle. In the howstuffworks website I also found a reference to "The Teenager's Guide to the Real World". I want to explore if this material contains anything interesting for my kids (7 and 10).
- Before sending this new information to James, I decide to enhance the readability of this report. Some sections are added and formatting changes have been applied.

[Journal Entry: April 9, 2009]

- Googling Trey Klein leads me (through LinkedIn) to only 1 match. This Trey Klein is an Architect – QA Analyst at Autodesk. This doesn't seem to lead to anything valuable.
- I feel that I am running in circles. I may need to ask some questions to James to eliminate some false assumptions or ideas. I feel that there are a lot more sequences of characters to share and I ask James if he can give me the missing sequences. James wants to know which sequences have my interest, and I provide the following answer.

  On Thu, Apr 9, 2009 at 9:58 PM, Van Trier,Erwin
  How would the following sequence of numbers complete?

  0 0 0 0 0
  7 7 7 7 7
  8 8 8 8 8
  9 9 9 9 9
  A A A A A

  In the information on your blog there is the following sequence
  1 1 1 1 1 = 5
  Are there any other sequences of characters that start with 1 1 1 1 1?
  If so, can you tell me how many?

- I am asking for the these specific numbers because I would like to know if the numbers are limited to range 1 – 6, or if the numbers are really character values. I receive the following answer.

On Fri, Apr 10, 2009 at 1:40 AM, Bach, James

0 0 0 0 0 = 0
7 7 7 7 7 = 8
8 8 8 8 8 = 4
9 9 9 9 9 = 0
A A A A A = ERROR
10 10 10 10 10 = 5

- There are no other sequences that start 1 1 1 1 1 except 1 1 1 1 1.
- I notice that the numbers are not limited to the 1 – 6 range, and also notice that I get an answer for something I did not ask for (10 10 10 10 10 = 5). I assume that James was not clear if I considered 'A' to be a letter or a HEX value. His answer indicates that these characters really need to be considered as numeric values and that I need to formulate my questions more carefully.

[Journal Entry: April 13, 2009]

- Just by looking at the previous answers I find that to solve the puzzle it is not sufficient to find the numerical value represented by '?'. The puzzle is solved when I find the algorithm that would allow me to complete any entry.
- These entries remind me of matrix theory in algebra.
- I try if I can solve the puzzle by applying a matrix representation is a 'basic' addition exercise and apply the following formula: A*[V1] + B*[V2] + C*[V3] + D*[V4] + E*[V5] = G (A,B, … being the numbers as given by James. See Ref_02).
- Applying this formula to row 1 1 1 1 1 = 5 I get
  1*[V1] + 1*[V2] + 1*[V3] + 1*[V4] + 1*[V5] = 5
- Applying this formula to row 1 1 1 1 2 = 1 I get
  1*[V1] + 1*[V2] + 1*[V3] + 1*[V4] + 2*[V5] = 1
- Subtracting the 2 entries results in 1*[V5]=-4 (or [V5]=-4)

- Applying this formula to row 2 2 2 2 2 = 1 I get
  2*[V1] + 2*[V2] + 2*[V3] + 2*[V4] + 2*[V5] = 1
- Applying this formula to row 1 1 1 1 2 = 1 I get
  2*[V1] + 2*[V2] + 2*[V3] + 2*[V4] + 3*[V5] = 6
- Subtracting the 2 entries results in 1*[V5]=5 (or [V5]=5)

- Since [V5] results in being 2 different values, I conclude that the used matrix formula can not be correct.
- I have also asked James to answer the following question.

"
Within the scope of this puzzle could you complete the following sequence for me
1 =
2 2 =
3 3 3 =
4 4 4 4 =
5 5 5 5 5 =
6 6 6 6 6 6 =
7 7 7 7 7 7 7 =
"

- I receive the reply below.

  “

  You already have the result for 5 5 5 5 5

  The others would return error.

  “

[Journal Entry: April 15, 2009]

- I’m stuck and I’m extremely disappointed. Initially I was super excited about the matrix theory. I was sure that this would lead me to the solution. However, after applying what I knew about matrix theory I didn’t get any closer to a result. This thing is like an emotional roller coaster.
- I decide to take a step back and read what I have written in the report so far. Maybe I just made a logical mistake in applying my ideas. There are still some ideas to be explored.
- I report to James about my excitement and disappointment about the matrix theory. James replies that he didn’t see me demonstrate that matrix theory does not work. “… don’t confuse not yet succeeding with proving that something can't work …”

[Journal Entry: April 16, 2009]

- I reply to James that my demonstration is based on the fact that I get to conflicting results for [V5] (5, and -4)
- After reading my notes in the report, I still don’t feel like exploring the open ideas. I keep on thinking that there is something in my matrix theory that I overlooked.
- I still can’t find anything wrong with the formula. I decide to take another step back, and re-analyse all my input. Looking at things from a different angle may reveal something.
- Theory:
- If
- The formula is correct
- And [V5]=5
- And [V5]=-4
- Then
- -4 must be equal to 5
- Now I question myself and try to find a context where 5 would be to -4
- BAM!!! Found the answer! Ship ahoy Buccaneeers! 5=-4 in a MOD 9 equation !
- The only thing that I need to know are the corresponding values for [Vx], x=1-5.
- The formula now becomes A*[V1] + B*[V2] + C*[V3] + D*[V4] + E*[V5] = G MOD 9

[Journal Entry: April 16, 2009]

- Once I found the generic formula and once I discovered that it was a mod 9 equation I knew that I could apply additions, subtractions and multiplications between rows.

  if X1 = Y1 mod Z; and
  X2 = Y2 mod Z
  then
  (X1 - X2) = (Y1 - Y2) mod Z
  (X1 + X2) = (Y1 + Y2) mod Z
  (X1 * X2) = (Y1 * Y2) mod Z

- By doing this I arrived at the following new (matrix)entries

  1 0 0 0 0 3
  0 1 0 0 0 1
  0 0 1 0 0 4
  0 0 0 1 0 1
  0 0 0 0 1 5

- For modulator equations this means for the first row that

  1*[V1] = [Q1]*9 + 3 ; [Q1] being an integer >=0 . Substituting [Q1] with the lowest possible number (0) I arrive at [V1] = 3.

- Applying the same rationale to the other rows I get

  [V1] = 3
  [V2] = 1
  [V3] = 4
  [V4] = 1
  [V5] = 5

- Solution found. The complete formula is
- A*3 + B*1 + C*4 + D*1 + E*5 = G MOD 9
-

List of tasks

Task ID	Description	Task notes
Task_01:	Verify the frequency of '1'	I copied the entries in a csv file and opened in MS EXCEL. 37% of the digits are '1'.
Task_02:	Verify the frequency of '2'	I copied the entries in a csv file and opened in MS EXCEL. 26% of the digits are '2'.
Task_03:	organize a variables grid	
Task_04:	organize a variables grid	Duplicate of task 3.
Task_05:	Verify the assumption that this is a math puzzle	The blog entry states the following. **"**A lot of my learning is motivated by puzzles. I particularly like math puzzles. Here's one:**"**

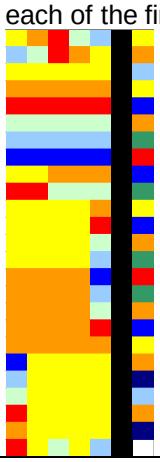
List of Questions

Question ID	Description	Question notes
Quest_01:	24 entries	Why 24 while there are far less terms/factors?
Quest_02:	Row sequence	Would the sequence of rows have any impact? Sorted the complete table for each column. Nothing special seems to surface when keeping one value fixed
Quest_03	Calculation based on column?	Verified if the solution is to be calculated based on the column info, not on row info. Used sum() function in MS Excel to calculate columns totals. Nothing specific seems to stand out.
Quest_04	Meaning of '='	Does the '=' sign really mean the mathematical '='?
Quest_05	Objective of exercise.	What is the real objective of this exercise? The verbiage in the blog indicates that there is a learning objective while trying to solve the listed puzzle. I am sure that many puzzlers are thinking that the puzzle is solved when you find the numeric value for '?'. I am not so sure that this is a correct assumption. [April 13, 2009] I determined that the puzzle is solved when I find the algorithm that would allow me to complete any entry.

List of Ideas

Idea ID	Description	Idea notes
Idea_01:	Variables in 1 sequence.	Seeing the display on the Buccaneer website triggered the idea to put the entries in a string instead of multiple rows.
Idea_02:	Color coding	Each color may represent a color code. Replacing numbers by a color may reveal interesting information.
Idea_03	Sports game	Some standings in sports show multiple statistics. Not every statistic per team contributes to the total number of points for a team. Maybe there are some columns that don't contribute to the end result.
Idea_04	ASCII chars	Maybe replacing each number by the value of its ASCII character may reveal interesting information.
Idea_05	Roman numerals	
Idea_06	UPC Barcode	
Idea_07	Trey Klein	
Idea_08	Invisible combinations	

Referenced / created material

Ref ID	Reference Notes
Ref_01:	Replacing each value with a unique color results in the picture below. This does not seem to reveal anything I can work with. I have also sorted the data per each of the first 5 columns. This did not reveal any color scheme either. 
Ref_02:	To create a grid of variables I use the MS Excel reference methodology. Columns are represented by letters; the rows are represented by numbers. The grid is listed below. The cell with blue background is labeled as C2. Note that I even use a reference for the blank line. That blank line may be important in solving the puzzle.

	A	B	C	D	E	F	G
1	1	2	3	4	5	=	1
2	5	4	3	2	1	=	2
3	1	1	1	1	1	=	5
4	2	2	2	2	2	=	1
5	3	3	3	3	3	=	6
6	4	4	4	4	4	=	2
7	5	5	5	5	5	=	7
8	6	6	6	6	6	=	3
9	1	1	2	2	2	=	6
10	3	3	4	4	4	=	7
11	1	1	1	1	2	=	1
12	1	1	1	1	3	=	6
13	1	1	1	1	4	=	2
14	1	1	1	1	5	=	7
15	2	2	2	2	6	=	3
16	2	2	2	2	5	=	7
17	2	2	2	2	4	=	2
18	2	2	2	2	3	=	6
19	2	2	2	2	2	=	1
20	6	1	1	1	1	=	2
21	5	1	1	1	1	=	8
22	4	1	1	1	1	=	5
23	3	1	1	1	1	=	2
24	2	1	1	1	1	=	8
25							
26	3	1	4	1	5	=	?

Things I have learned that are not directly related to the puzzle itself

- MS Excel 2002 only allows a maximum of 3 conditions when applying conditional formatting to a cell.
- How to use the Styles and Formatting feature in MS Word.
- How UPC Barcodes work. See website http://www.howstuffworks.com/upc.htm
- There is such a thing as 'The Teenager's Guide to the Real World'
- Using Microsoft Word's bullet list and formatting features is extremely painful. There most be some serious flaws in these features. (… but really this is not something new that I have learned)