CSE 565 Assignment 3 – Design of Experiments

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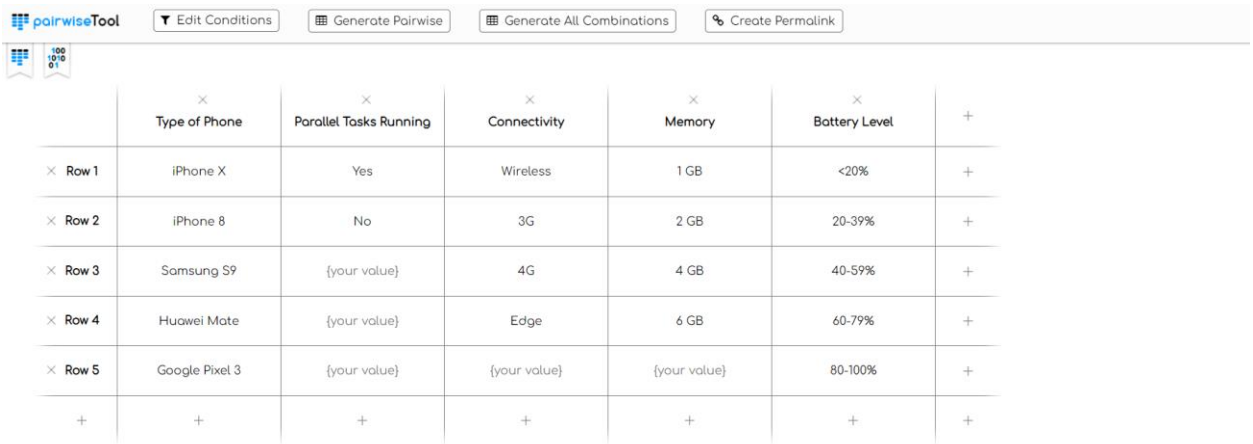
I. Description of DOE Tool

The tool used here is the pairwiseTool, which is an online tool that generates all possible combinations of each item in a list, providing a 100% test coverage. This tool uses a technique based on permutations and combinations that generates pairwise combinations to be used as test cases.

The purpose of this tool is to mitigate the efforts of testing software by taking all possible combinations of input parameters and generating pairwise combinations. This helps testers to guarantee that they have tested the software for all possible scenarios without manually writing all the test cases, reducing the manpower and time required for this task.

A same example has been included to ease the understanding of the reader. The use case considered here is for testing a mobile application. The requirements are as shown in the Figure 1.



	Type of Phone	Parallel Tasks Running	Connectivity	Memory	Battery Level
Row 1	iPhone X	Yes	Wireless	1 GB	<20%
Row 2	iPhone 8	No	3G	2 GB	20-39%
Row 3	Samsung S9	{your value}	4G	4 GB	40-59%
Row 4	Huawei Mate	{your value}	Edge	6 GB	60-79%
Row 5	Google Pixel 3	{your value}	{your value}	{your value}	80-100%

Figure 1 Mobile Application Testing Specifications

As shown in Figure 1, there are 5 features that we are taking into account in this example, namely type of phone, parallel tasks running, connectivity, memory and battery level, with some missing values. In order to conduct testing, the mobile

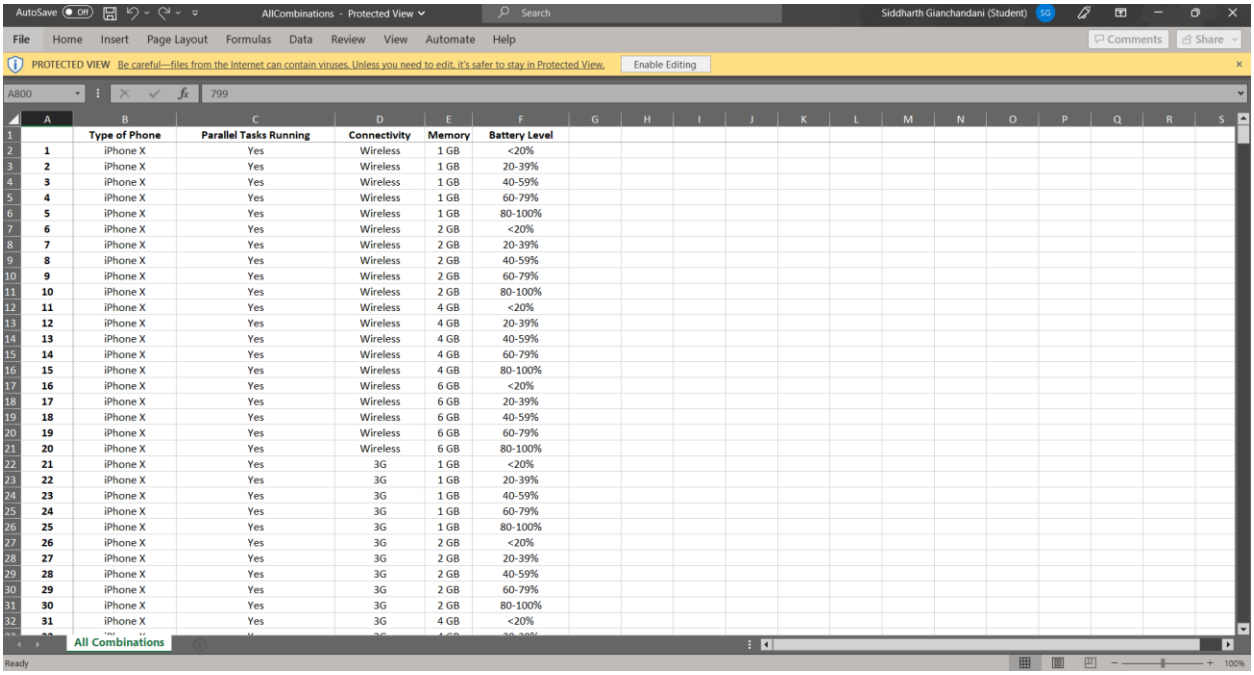
application needs to be tested with various combinations of input data. Instead of doing this manually, the mobile application has been tested by the test cases generated by the DOE tool.

II. Test Cases

The DOE tool, pairwiseTool, generated 800 test cases for all different combinations of input data. This number was reduced to 25 test cases for pairwise combinations. Hence, we can see that using only 25 test cases, we can make certain that we have a 100% test coverage. This number is much lesser than the 800 test cases that are generated by all combinations of input parameters and helps us understand by DOE tools are helpful in mitigating testing efforts.

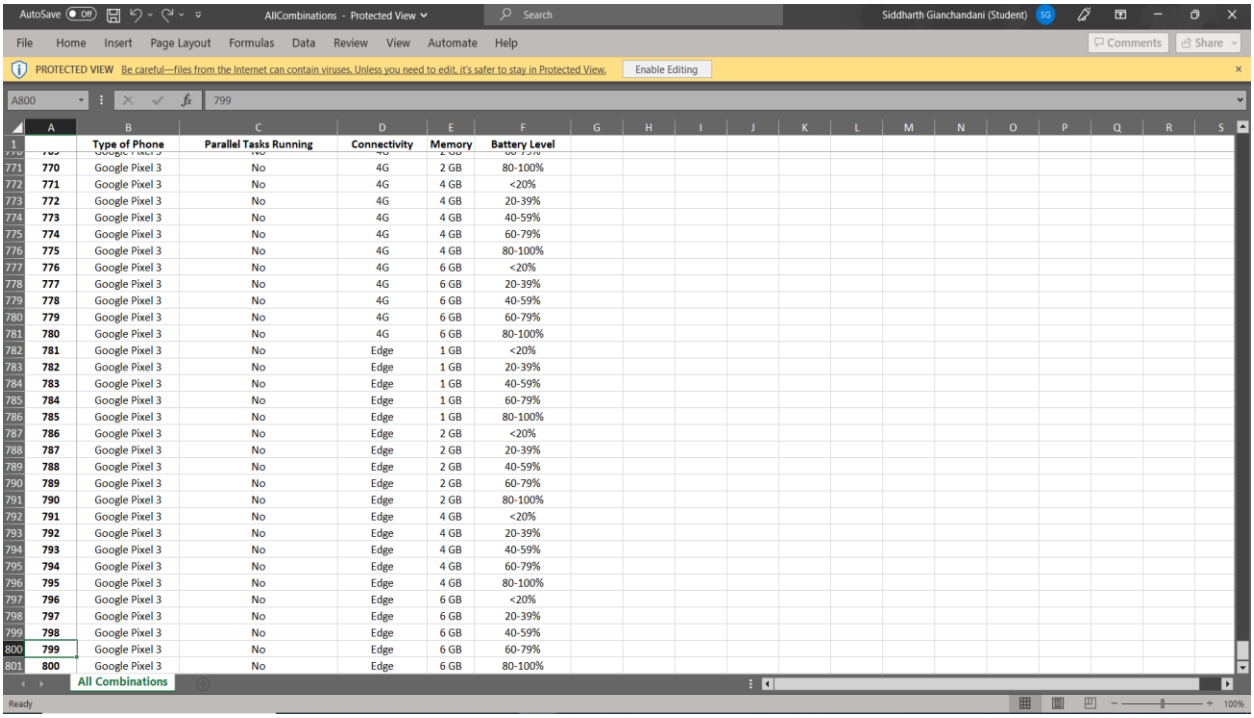
III. Screen shots of test cases generated by DOE Tool

The screenshots for all the test cases generated by pairwiseTool (all combinations and pairwise combinations) are included below. Note that these test cases are included in excel worksheets that are generated by pairwiseTool automatically and are available for download. Figures 2 and 3 show the starting and the ending of the file containing the 800 test cases generated for all combinations specifically. Test cases generated for pairwise combinations are shown in Figure 4.



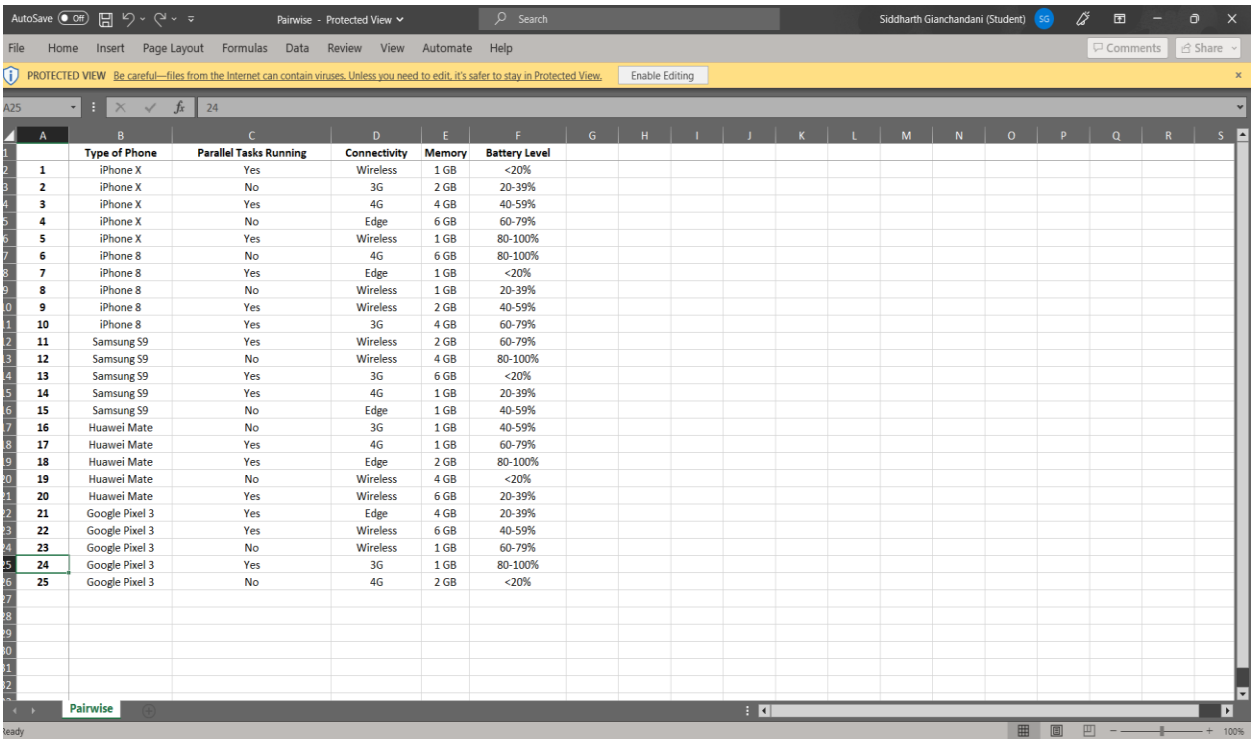
	Type of Phone	Parallel Tasks Running	Connectivity	Memory	Battery Level
1	iPhone X	Yes	Wireless	1 GB	<20%
2	iPhone X	Yes	Wireless	1 GB	20-39%
3	iPhone X	Yes	Wireless	1 GB	40-59%
4	iPhone X	Yes	Wireless	1 GB	60-79%
5	iPhone X	Yes	Wireless	1 GB	80-100%
6	iPhone X	Yes	Wireless	2 GB	<20%
7	iPhone X	Yes	Wireless	2 GB	20-39%
8	iPhone X	Yes	Wireless	2 GB	40-59%
9	iPhone X	Yes	Wireless	2 GB	60-79%
10	iPhone X	Yes	Wireless	2 GB	80-100%
11	iPhone X	Yes	Wireless	4 GB	<20%
12	iPhone X	Yes	Wireless	4 GB	20-39%
13	iPhone X	Yes	Wireless	4 GB	40-59%
14	iPhone X	Yes	Wireless	4 GB	60-79%
15	iPhone X	Yes	Wireless	4 GB	80-100%
16	iPhone X	Yes	Wireless	6 GB	<20%
17	iPhone X	Yes	Wireless	6 GB	20-39%
18	iPhone X	Yes	Wireless	6 GB	40-59%
19	iPhone X	Yes	Wireless	6 GB	60-79%
20	iPhone X	Yes	Wireless	6 GB	80-100%
21	iPhone X	Yes	3G	1 GB	<20%
22	iPhone X	Yes	3G	1 GB	20-39%
23	iPhone X	Yes	3G	1 GB	40-59%
24	iPhone X	Yes	3G	1 GB	60-79%
25	iPhone X	Yes	3G	1 GB	80-100%
26	iPhone X	Yes	3G	2 GB	<20%
27	iPhone X	Yes	3G	2 GB	20-39%
28	iPhone X	Yes	3G	2 GB	40-59%
29	iPhone X	Yes	3G	2 GB	60-79%
30	iPhone X	Yes	3G	2 GB	80-100%
31	iPhone X	Yes	3G	4 GB	<20%

Figure 2 Starting of the file of test cases generated for all combinations



	A	Type of Phone	Parallel Tasks Running	Connectivity	Memory	Battery Level
771	770	Google Pixel 3	No	4G	2 GB	80-100%
772	771	Google Pixel 3	No	4G	4 GB	<20%
773	772	Google Pixel 3	No	4G	4 GB	20-39%
774	773	Google Pixel 3	No	4G	4 GB	40-59%
775	774	Google Pixel 3	No	4G	4 GB	60-79%
776	775	Google Pixel 3	No	4G	4 GB	80-100%
777	776	Google Pixel 3	No	4G	6 GB	<20%
778	777	Google Pixel 3	No	4G	6 GB	20-39%
779	778	Google Pixel 3	No	4G	6 GB	40-59%
780	779	Google Pixel 3	No	4G	6 GB	60-79%
781	780	Google Pixel 3	No	4G	6 GB	80-100%
782	781	Google Pixel 3	No	Edge	1 GB	<20%
783	782	Google Pixel 3	No	Edge	1 GB	20-39%
784	783	Google Pixel 3	No	Edge	1 GB	40-59%
785	784	Google Pixel 3	No	Edge	1 GB	60-79%
786	785	Google Pixel 3	No	Edge	1 GB	80-100%
787	786	Google Pixel 3	No	Edge	2 GB	<20%
788	787	Google Pixel 3	No	Edge	2 GB	20-39%
789	788	Google Pixel 3	No	Edge	2 GB	40-59%
790	789	Google Pixel 3	No	Edge	2 GB	60-79%
791	790	Google Pixel 3	No	Edge	2 GB	80-100%
792	791	Google Pixel 3	No	Edge	4 GB	<20%
793	792	Google Pixel 3	No	Edge	4 GB	20-39%
794	793	Google Pixel 3	No	Edge	4 GB	40-59%
795	794	Google Pixel 3	No	Edge	4 GB	60-79%
796	795	Google Pixel 3	No	Edge	4 GB	80-100%
797	796	Google Pixel 3	No	Edge	6 GB	<20%
798	797	Google Pixel 3	No	Edge	6 GB	20-39%
799	798	Google Pixel 3	No	Edge	6 GB	40-59%
800	799	Google Pixel 3	No	Edge	6 GB	60-79%
801	800	Google Pixel 3	No	Edge	6 GB	80-100%

Figure 3 Ending of the file of test cases generated for all combinations



	A	Type of Phone	Parallel Tasks Running	Connectivity	Memory	Battery Level
2	1	iPhone X	Yes	Wireless	1 GB	<20%
3	2	iPhone X	No	3G	2 GB	20-39%
4	3	iPhone X	Yes	4G	4 GB	40-59%
5	4	iPhone X	No	Edge	6 GB	60-79%
6	5	iPhone X	Yes	Wireless	1 GB	80-100%
7	6	iPhone 8	No	4G	6 GB	80-100%
8	7	iPhone 8	Yes	Edge	1 GB	<20%
9	8	iPhone 8	No	Wireless	1 GB	20-39%
10	9	iPhone 8	Yes	Wireless	2 GB	40-59%
11	10	iPhone 8	Yes	3G	4 GB	60-79%
12	11	Samsung S9	Yes	Wireless	2 GB	60-79%
13	12	Samsung S9	No	Wireless	4 GB	80-100%
14	13	Samsung S9	Yes	3G	6 GB	<20%
15	14	Samsung S9	Yes	4G	1 GB	20-39%
16	15	Samsung S9	No	Edge	1 GB	40-59%
17	16	Huawei Mate	No	3G	1 GB	40-59%
18	17	Huawei Mate	Yes	4G	1 GB	60-79%
19	18	Huawei Mate	Yes	Edge	2 GB	80-100%
20	19	Huawei Mate	No	Wireless	4 GB	<20%
21	20	Huawei Mate	Yes	Wireless	6 GB	20-39%
22	21	Google Pixel 3	Yes	Edge	4 GB	20-39%
23	22	Google Pixel 3	Yes	Wireless	6 GB	40-59%
24	23	Google Pixel 3	No	Wireless	1 GB	60-79%
25	24	Google Pixel 3	Yes	3G	1 GB	80-100%
26	25	Google Pixel 3	No	4G	2 GB	<20%

Figure 4 Test cases generated for pairwise combinations

IV. Assessment of DOE Tool

This tool is user-friendly and undemanding. It has an intuitive GUI that generates test cases automatically in two possible ways, namely all combinations and pairwise combinations, and these test cases can be downloaded for future use.

The tool guarantees a testing coverage of 100% for pairwise combinations as well as all the combinations that can be generated, but this tool is not suitable for generating test cases for higher-order combinations.

There are four primary features of this tool. There are:

1. This tool generates test cases for all combinations and pairwise combinations.
2. This tool generates test cases in excel worksheets that can be downloaded.
3. This tool allows us to create certain conditions for the features in the specifications of mobile applications like which values from a certain feature in the specifications can/cannot exist with specific values from another feature in the specifications, as shown in Figure 5.
4. This tool allows us to create a permanent link for our specifications. This helps testers in retaining their data on the tool and sharing this with other shareholders to ease the discussions about the requirements and testing of the software.

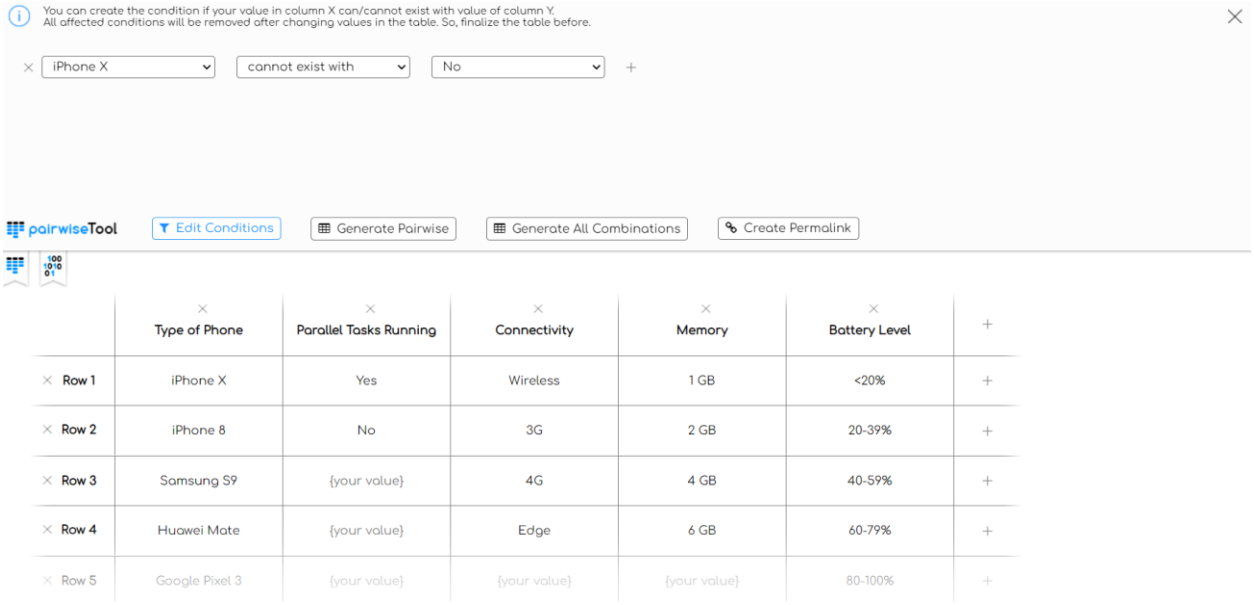


Figure 5 Feature that allows us to add certain conditions for specific values of the features in specifications

V. References

1. https://www.softwaretestinghelp.com/what-is-pairwise-testing/
2. https://www.pairwise.org/tools.html
3. https://pairwise.teremokgames.com/