DECISION MODEL FOR ANTI-VIRUS SOFTWARE SELECTION

To help common people in choosing the right antivirus for them.

SRAVYA PAGADALA

NIKHITHA LINGUTLA

POOJA GURUNATH

SYST -573
FINAL PROJECT REPORT

6th May 2019

Contents

1. Team Introduction and Project Motivation

We are a team of three - *Nikhita Lingutla, Gurunath Pooja Jawalker and Sravya Pagadala.* We have formulated a decision-making model for antivirus software consumer. We present here, our implementation of the decision analysis concepts and techniques learned in this class.

There's no longer any question about whether you should use antivirus software. It doesn't matter if you're running Windows, Android or macOS — there's malware out targeting your machine. There are so many options on the market that you may not know which to choose. You know that you need an antivirus, but you do not know which criteria it should meet. All security companies market their products as being the best, having the greatest antivirus or firewall, being complete products and so on and so forth. But what kind of antivirus software should you get? Will you need to pay for it, or is free software good enough? Whom should you trust? How should you choose your antivirus?

There are a lot of factors to consider when you're trying to select the best antivirus solution for your needs. With the security of your data, digital identity and financial transactions at stake, it's worthwhile investing some time in assessing each antivirus product and thus this motivated us to choose this topic for project.

This project will help common people in choosing the right antivirus for them.

2. Scope

Identifying which factors that need to be considered in choosing antivirus software ,organize and present Objectives, explore alternatives and find ways to quantify the alternatives in order to make a better decision for an antivirus software selection. **Decision Maker** is from a non –technical background having no clue about what to expect from an anti- virus software but the best option from the currently available anti-virus software in the market which is affordable.

3. Specific exclusions from the scope

As this project targets to help common people we choose to exclude the evaluation concern – "How does the antivirus software work?"

We don't wish to categorize which software to use based on its functionality such as –

- Is it a network level protection technology with Intrusion Prevention layer ?
- Is it a File based protection?
- Is it a Reputation based protections?
- Is it a Behavior based protection?

4. High-Level Project Plan

5. Brainstorming and identifying variables

Brainstorming and understanding the factors that need to be considered for selecting antivirus software.

- **Online rating & feedback**
  One of the key things is looking for whether an anti-virus software has online ratings and reviews. A recent study from Brightlocal found that 84% of today's consumers trust online ratings and reviews as much as they trust the recommendation of a friend or family member.

- **Hard disk space usage**
  How much is the anti-virus software taking up space on your hard drive is also crucial. You have to be sure to determine how the anti-virus impacts the speed of your computer, particularly if your workflow involves your computers to be a fast day in and day out. There is some anti-virus software out there that can affect the speed of the computer they are installed in. If your computer is not the most powerful on the market, you should take into consideration the performance aspect.

- **Customer care service**
  Checking whether the customer service team responsive and knowledgeable? Nothing in this world is perfect, so being able to call for help when something does not work as it should, is important. That is why the support options you get are a factor to consider before deciding to buy a security product.

- **Schedule a scan feature**
  Is this feature available in the anti-virus software?

- **Scan logs report availability**
  Scan logs are an inspection of the potential points of exploit on a computer or network. Monitoring and analyzing user and system activity can help detect patterns of normal use and potentially malicious users.

- **Multiplatform, multi-device licenses**
  If you've decided to pay for antivirus protection, and you have a lot of computers and smartphones, check out the bundles that cover several Windows, OS X and Android devices for a single price.

- **Try before you buy option (try a month for free)**
  Most paid antivirus products on Mac and Windows will let you try a month for free. Most Android antivirus apps use a freemium model in which the basics are free, but useful extra features must be paid for. A good security suite offers protection for multiple devices like PCs, Macs, smartphones, and tablets. It keeps up with the needs of the individual, knows the risks associated with each device, and offers comprehensive protection for many devices.

- **Malware detection rate**
  Since the role of antivirus software is to detect threats, it should do so flawlessly. You'll want to make sure the antivirus software stops more than 95 percent of malware, whether it's commonplace malware or brand-new zero-day malware. But make sure that detection rate isn't accompanied by a high rate of false positives, which are benign files mistakenly flagged as malware.

- **Privacy Filter**
  If you're about to inadvertently divulge personal information, a privacy filter will provide a warning

- **Parental controls**
  This blocks access to certain sites unsuitable for children.
  To help keep your family protected from online threats, look for parental control features. Features to look for include content filters that prevent kids from visiting websites that are inappropriate for their age, time supervision, and social media and messaging-apps monitoring.

- **File Shredders**

This feature removes all electronic traces of an infected file.
Deleting a file from your hard drive does not remove all electronic traces of it, which can allow someone who accesses or inherits your computer to recover some or all of the file's data. To eliminate that possibility, you need file-shredding software. Some pay antivirus suites include a file shredder.

- **Spam Filters**

The filters provided by many email programs or internet service providers might be all you need to block unwelcome mail. The antispam feature on suites (and standalone, and often free, programs) offers supplementary assistance if too many junk email messages are still getting through.

- **Frequency and regularity of updates for the software**

How frequently the antivirus software fixes bugs if any and gets updates is also critical as else it may be outdated.

- **Installation setup ease**

If it requires just one download and installation and a single upgrade to its database when necessary. Its single interface can also be easier to use than multiple stand-alone programs.

- **No excessive memory uses**

A light touch that won't slow your system down. While any antivirus program will use some of your computer's resources, a good antivirus program should keep your system free of malware without significantly slowing down your system's performance. In testing, the best antivirus software exacts almost no drag on performance.

- **Anti-worm, Anti Trojan and Antispyware**

These features are meant to provide comprehensive protection in one package. They offer not only malware protection but also a firewall, an antispam filter, and other extras.

- **Full System Scan**

Checks all boot records, files, and running processes.

- **Subscription Price**

Most paid antivirus programs provide updates only for one year, so be prepared to pay annual renewal fees. Although some antivirus programs come with free telephone support, it is rare to find this feature with free software. Even online or chat support isn't guaranteed with free products.

- **Data and identity protection**

An antivirus solution should deliver constant protection for all computer domains, all types of files and all network elements that could be subject to attack by a computer virus or other malware.

- **Scan speed and accuracy**

In testing, the best antivirus software exacts almost no drag on performance.

- **User-friendly (See how easy the software is to use)**

Because antivirus software can be customized, it's important that the interface guides users through the various settings. An intuitive interface is essential.

- **Internet security**

Spotting a virus that's widespread is a fairly easy task for most security software. It's harder, however, to squash a bug that's just been released in the wild. Top antivirus software products monitor files and processes, identifying brand-new viruses by spotting activity that is virus-like, and without tripping excessive false alarms (see above).

- **Loading speed**

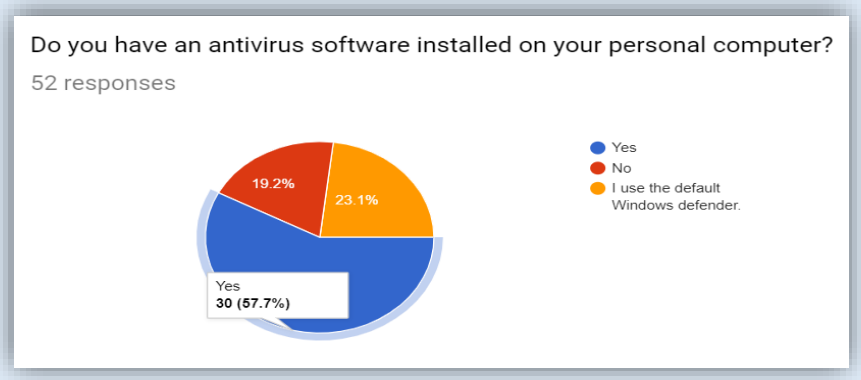
Yes, antivirus software does slow down Windows PCs, but while some programs are barely noticeable, others are much worse. The result indicates that good security software does not heavily slow down a Windows PC. These security packages cause the copying routine to run 2.5 to 3 times more slowly than with Kaspersky software, for instance.

6. Data Acquisition

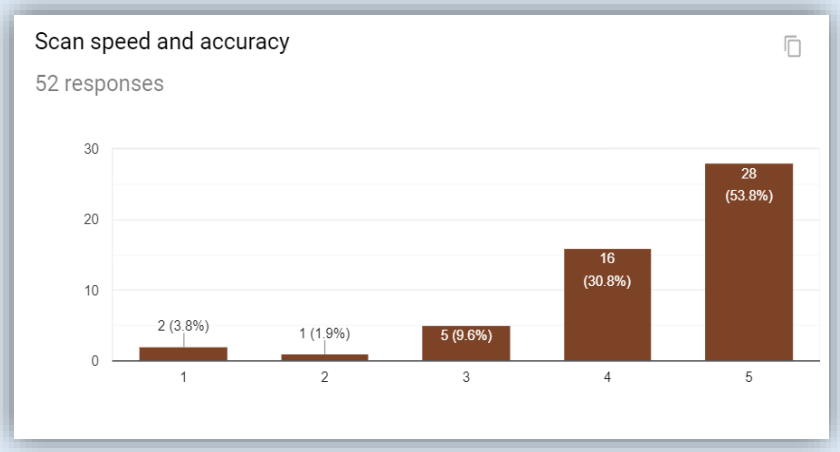
First, we spread questionnaires to the consumer about their opinion on the factors identified after the brainstorming section. We have asked a set of questions in the survey using Google forms and 52 responses are exported for further analysis. All the responses will be contributing data to build the decision model which benefit common people to make a better decision for selecting antivirus software.

Below are some interesting facts from the response form:

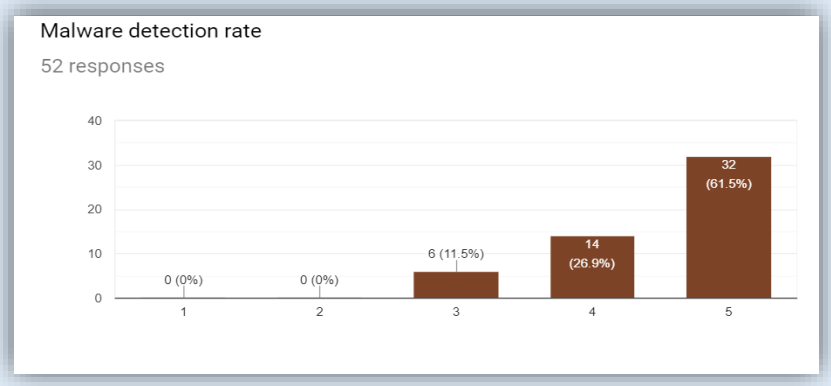
- More than 50% of the audience have an anti-virus software installed in the system.



- Scan speed and accuracy is very essential for more than 88% of the audience.



- Malware detection rate is also given much importance as % of audience expect good malware detection rate.



7. Factor Analysis using SPSS

The 23 variables are then divided into factors by using factor analysis method in SPSS software. The determination of the number of factors to extract should be guided by theory, but also informed by running the analysis extracting different numbers of factors and seeing which number of factors yields the most interpretable results. we have included many options, including the original and reproduced correlation matrix, the scree plot and the plot of the rotated factors. This variable then divided into factors by using factor analysis method in SPSS software.
SPSS Annotated output explanation :
Factor analysis is a method of data reduction and from 23 variables 13 variables are extracted as output from SPSS. The following are the 13 variables :
Multi-Platform, Multi-device licenses, Full System Scan, Hard disk space usage, File Shedders, Schedule a scan feature, Try before you buy, Scan logs reports availability, Frequency, and regularity of updates for software, Installation setup ease, Online rating & feedback, Parental Controls, Privacy Filter, Anti-worm, Anti Trojan and Antispyware

Descriptive Analytics :

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
HDSU	3.8235	1.12616	51
SLRA	4.0588	.90359	51
SSF	3.8431	1.06532	51
MM	3.8039	1.14925	51
TBY	4.1569	1.04638	51
FS	4.0588	1.22330	51
PC	3.8431	1.33225	51
PF	4.0196	1.08610	51
FSSCAN	4.2549	.84482	51
ANTI	4.2941	.85543	51
FREQ	3.9216	.93473	51
INST	4.0980	1.08176	51
ORFB	3.9412	1.02785	51

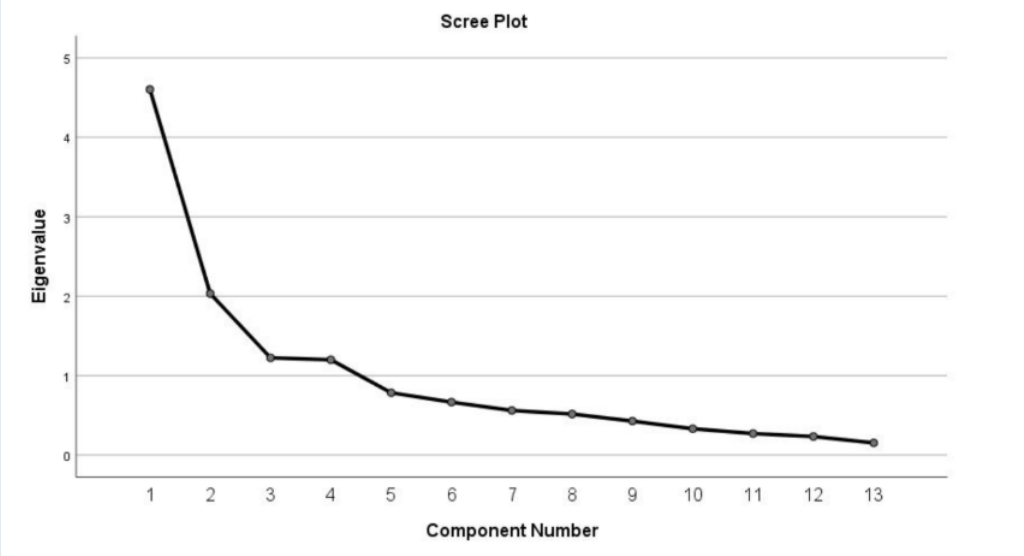
a. Mean – These are the means of the variables used in the factor analysis.
b. Std. Deviation – These are the standard deviations of the variables used in the factor analysis.
c. Analysis N – This is the number of cases used in the factor analysis.

KMO and Bartlett's Test
a. Kaiser-Meyer-Olkin Measure of Sampling Adequacy – This measure varies between 0 and 1, and values closer to 1 are better. A value of .6 is a suggested minimum. Our value is 0.721 and thus we can perform further analysis.
b. Bartlett's Test of Sphericity – This test the null hypothesis that the correlation matrix is an identity matrix. An identity matrix is matrix in which all of the diagonal elements are 1 and all off diagonal elements are 0. You want to reject this null hypothesis. We reject the null hypothesis as the correlation matrix is not an identity matrix.
Taken together, these tests provide a minimum standard which should be passed before a factor analysis to be conducted and after interpreting the results from SPSS we conclude that both the tests have cleared.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.721
Bartlett's Test of Sphericity	Approx. Chi-Square	262.994
	df	78
	Sig.	.000

Scree plot :



The **scree plot** graphs the **eigenvalue against the factor number**. You can see these values in the first four columns of the table immediately above. From the fifth factor on, you can see that the line is almost flat, meaning each successive factor is accounting for smaller and smaller amounts of the total variance. We can infer that we shall have four components which have eigen value greater than one.

Rotated Component Matrix :

Thus so far, we concluded that our 13 variables probably measure 4 underlying factors. But which items measure which factors? The component matrix shows the Pearson correlations between the items and the components.
The below cells are highlighted using the following approach :

- Check the component values with the adjacent component and group them into one unless the value in the other component is higher than the first component. If the value is higher then shift to component two values and then performe the above operation again. Similary highlight the cells in the rotated component matrix for all the variables.
- Among the highlighted cells , the variable with lowest value will be romved in this iteration.

Rotated component matrix : Iteration 1

	Component					
	1	2	3	4	5	6
DATA	0.793	0.328	0.214	0.083	0.123	0.033
MDR	0.711	0.265	0.123	0.140	0.161	0.173
IS	0.682	0.336	0.200	0.053	0.515	0.094
SSA	0.650	0.403	0.154	0.049	0.438	0.125
SUBSPRICE	0.649	-0.088	0.406	0.258	0.237	0.053
ORFB	0.534	0.001	0.143	0.037	-0.136	0.527
FS	0.321	0.779	0.051	0.190	0.132	0.007
PC	0.056	0.775	0.172	0.121	0.148	0.096
PF	0.278	0.707	0.303	-0.005	0.189	-0.228
MM	-0.020	0.661	-0.019	-0.097	0.222	0.518
SLRA	0.304	0.600	-0.054	0.435	-0.168	0.131
SF	0.259	0.559	-0.382	0.231	0.215	0.200
BY	0.135	0.033	0.811	-0.020	-0.032	0.119
FSSCAN	0.295	0.111	0.723	0.288	0.125	0.145
ANTI	0.254	0.313	0.619	0.365	0.094	-0.058
INST	-0.015	-0.067	0.318	0.804	0.212	0.115
FREQ	0.142	0.304	0.089	0.762	0.080	-0.026
NEMU	0.466	0.086	0.435	0.484	0.166	0.288
EMOE	0.451	0.353	-0.190	0.477	0.081	0.112
UF	0.172	0.114	-0.065	0.193	0.862	0.089
LS	0.336	0.391	0.199	0.109	0.607	0.257
SF	0.488	0.460	0.224	0.120	0.491	0.035
HDSU	0.155	0.090	0.136	0.143	0.220	0.780

The rotated component matrix in the second iteration is below:
Iteration 2

Rotated Component Matrixa

	Component					
	1	2	3	4	5	6
FS	0.789	0.286	0.092	0.155	0.116	0.011
PC	0.770	0.090	0.134	0.128	0.133	0.080
PF	0.695	0.281	0.324	0.194	-0.028	-0.228
MM	0.650	-0.053	0.011	0.249	-0.119	0.506
SLRA	0.643	0.290	-0.088	-0.170	0.395	0.145
SSF	0.592	0.210	-0.367	0.237	0.158	0.207
DATA	0.349	0.822	0.145	0.090	0.091	0.056
SUBSPRICE	-0.074	0.715	0.309	0.186	0.306	0.065
MDR	0.287	0.703	0.100	0.156	0.110	0.195
IS	0.341	0.687	0.183	0.510	0.042	0.106
SSA	0.413	0.653	0.130	0.431	0.039	0.139
[redacted]	0.463	0.498	0.207	0.487	0.117	0.040
TBY	0.003	0.148	0.838	-0.021	0.010	0.123
FSSCAN	0.108	0.304	0.722	0.132	0.310	0.157
ANTI	0.321	0.268	0.607	0.096	0.381	-0.047
UF	0.111	0.176	-0.061	0.866	0.183	0.075
LS	0.389	0.325	0.208	0.623	0.102	0.258
INST	-0.038	0.039	0.235	0.179	0.845	0.106
FREQ	0.351	0.157	0.029	0.065	0.757	-0.018
NEMU	0.110	0.500	0.365	0.141	0.511	0.298
HDSU	0.094	0.152	0.109	0.222	0.158	0.775
Online	0.023	0.494	0.144	-0.118	0.012	0.556

After 11 iterations , the below is the calculated rotated component matrix :

Rotated Component Matrixa

	Component			
	1	2	3	4
FS	0.843	0.173	0.150	0.054
PC	0.803	0.152	0.086	0.068
PF	0.736	0.424	0.010	-0.139
SSF	0.675	-0.295	0.193	0.236
MM	0.657	-0.036	-0.123	0.441
SLRA	0.646	0.000	0.389	0.105
TBY	-0.008	0.841	-0.042	0.150
FSSCAN	0.104	0.762	0.343	0.232
ANTI	0.290	0.668	0.443	0.044
FREQ	0.311	0.066	0.836	0.038
INST	-0.023	0.231	0.805	0.156
HDSU	0.162	0.064	0.130	0.808
Online	0.045	0.241	0.084	0.702

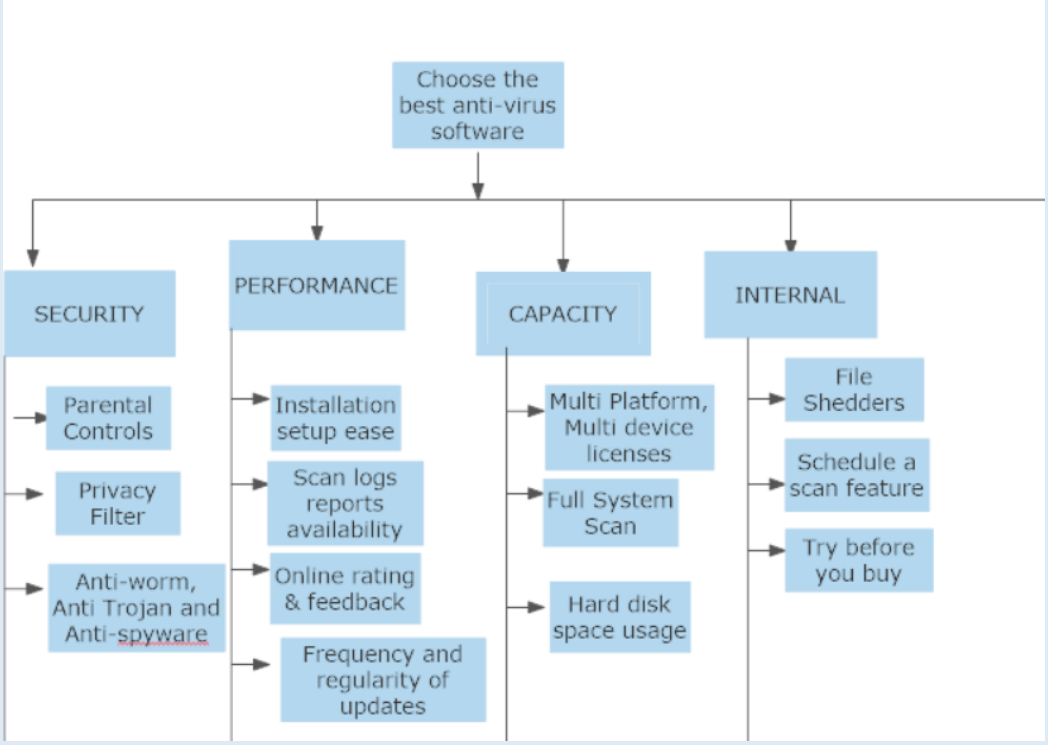
The 13 research variables are grouped to 4 factors. This is the result from Factor Analysis.

Final table with four factors: Capacity, Internal, Performance, Security is below:

S.no	Variable	Factors	Category
1	Multi Platform, Multi device licenses	capacity	A
2	Full System Scan	capacity	A
3	Hard disk space usage	capacity	A
4	File Shedders	internal	B
5	Schedule a scan feature	internal	B
6	Try before you buy	internal	B
7	Scan logs reports availability	performance	C
8	Frequency and regularity of updates for software	performance	C
9	Installation setup ease	performance	C
10	Online rating & feedback	performance	C
11	Parental Controls	security	D
12	Privacy Filter	security	D
13	Anti-worm, Anti Trojan and Antispyware	security	D

8. Affinity Diagram

Below is the Affinity diagram of **13 evaluation concerns, 4 criteria (factors)** for choosing best Anti-virus software. Ordered according to their importance. Evaluations concern's measurement analysis is explained below the affinity diagram.



Measures	Values
Multi Platform, Multi device licenses	1(If available) else 0
Full System Scan	1(If available) else 0
Hard disk space	Low, Moderate and High
File Shedders	1(If available) else 0
Schedule a scan feature	1(If available) else 0
Try before you buy	#of months trial for free
Scan logs reports availability	1(If available) else 0
Frequency and regularity of updates for software	1(If available) else 0
Installation setup ease	Low, Moderate and High
Online rating & feedback	Range of 1(low)-3(high)
Parental Controls	1(If available) else 0
Privacy Filter	1(If available) else 0
Anti-worm, Anti Trojan and Antispyware	Protection rate in %

9. Perform Analytic Hierarchy Process(AHP)

The AHP is a method to break apart the problem into a hierarchy of subproblems which can be easily comprehended and subjectively evaluated. The subjective evaluations are changed over into numerical values and processed to rank every evaluation consideration on a numerical scale.

The methodology of the AHP can be explained in following steps:

Step 1: The problem is decomposed into a hierarchy of goal, criteria, sub-criteria and alternatives. The first step in building the AHP model lies in the determination of the criteria that will be used. In our case after survey and factor analysis using SPSS, we ended up with 13 evaluation considerations. Next, we grouped the evaluation considerations into 4 categories.
Security, Performance, Capacity, Internal Features.
Step 2: Data are collected from experts or decisionmakers corresponding to the hierarchic structure, in the pairwise comparison of alternatives on a qualitative scale. The evaluation begins by determining the relative weight of the initial criteria groups. In our case we spread a questionnaire to 5 IT experts to rank the criteria based on SAATY Comparison Scale.

Scale	Numerical Rating	Reciprocal
Extremely Preferred	**9**	**1/9**
Very Strongly to extremely	8	1/8
Very Strongly preferred	**7**	**1/7**
Strongly to very strongly	6	1/6
Strongly preferred	**5**	**1/5**
Moderately to strong	4	1/4
Moderately preferred	**3**	**1/3**
Equally to moderately	2	1/2
Equally preferred	**1**	**1**

Step 3: The pairwise comparisons of various criteria generated at step 2 are organized into a square matrix. The relative weight data is shown between the criteria that have been determined by IT experts. Where we used excel sheets to carry on the evaluation for AHP process. Below is a snapshot of one of the IT expert's opinion on initial criteria.

	Security	performance	Capacity	Internal Features
Security	1	5	1/5	1/3
performance	1/5	1	1/3	1
Capacity	5	3	1	3
Internal Features	3	1	1/3	1

	Security	performance	Capacity	Internal Features
Security	1.00	3.06	2.91	2.16
performance	0.33	1.00	1.82	2.05
Capacity	0.34	0.55	1.00	1.93
Internal Features	0.46	0.49	0.52	1.00

Step 4: The principal eigenvalue and the corresponding normalized right eigenvector of the comparison matrix give the relative importance of the various criteria being compared. Geometric mean of all the IT experts ranking opinions has been normalized. Normalization is made by dividing each value by the total column value. Below is the snapshot of Geometric mean of all IT experts ranking.

And following is the snapshot of normalized matrix.

	Security	**performance**	**Capacity**	**Internal Features**
Security	0.4688	0.6006	0.4661	0.3022
performance	0.1530	0.1960	0.2912	0.2869
Capacity	0.1609	0.1077	0.1600	0.2708
Internal Features	0.2173	0.0957	0.0827	0.1401

The contribution of each criterion to the goal(Choose Anti-Virus Software) is determined by calculations made using the priority vector (or Eigenvector). The Eigenvector shows the relative weights between each criterion; it is obtained in an approximate manner by calculating the mathematical average of all criteria

	Eigenvector(Calculation)	**Eigenvector**
Security	(0.4688+0.6006+0.4661+0.3022)/4	0.4594
performance	(0.1530+0.1960+0.2912+0.2869)/4	0.2318
Capacity	(0.1609+0.1077+0.1600+0.2708)/4	0.1748
Internal Features	(0.2173+0.0957+0.0827+0.1401)/4	0.1340

Step 5: The consistency of the matrix of order n is evaluated. The next step is to look for any data inconsistencies. The objective is to capture enough information to determine whether the decision makers have been consistent in their choices. Obtained eigenvector is multiplied to the geometric mean matrix column-wise and find the sum row-wise which is weighted sum. Ratio of weighted sum to eigenvalues are calculated and average of all those values is considered as λmax. Calculated the Consistency Index by using formula $\mathrm{CI} = \frac{(\lambda\max - \mathrm{n})}{(\mathrm{n}-1)}$ where n = 4

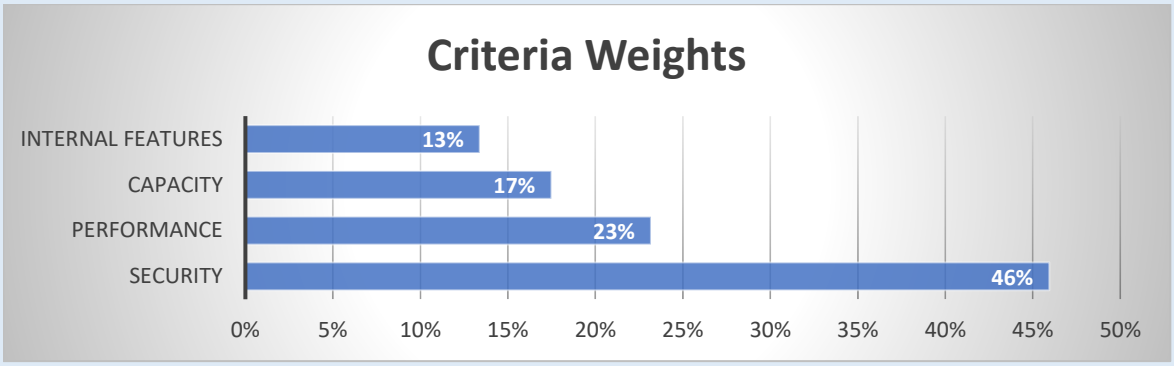
Consistency Ratio(CR) is the ratio of Consistency Index(CI) to Random Index(RI). The RI value is fixed and is based on the number of evaluated criteria where no of evaluated criteria is 4.

$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}}$

n	1	2	3	**4**	5	6	7	8	9	10
RI	0	0	0.58	**0.9**	1.12	1.24	1.32	1.41	1.45	1.49

CI = 0.059054902, RI = 0.9
CR = 0.059055/0.9 = 0.065617 < 0.1
The matrix will be considered consistent if the resulting ratio is less than 10%.

So, the criteria weights distributions were visualized by the histogram.



Just as done with the initial criteria group for the Anti-Virus software, it is necessary to evaluate the criteria's relative weights for the second level of the hierarchy. This process is executed just like the step to evaluate the first level of the hierarchy (criteria group) as it was shown above.
The following tables show the comparison matrices for the criteria with the pair-wise comparisons already taken by the decision makers.

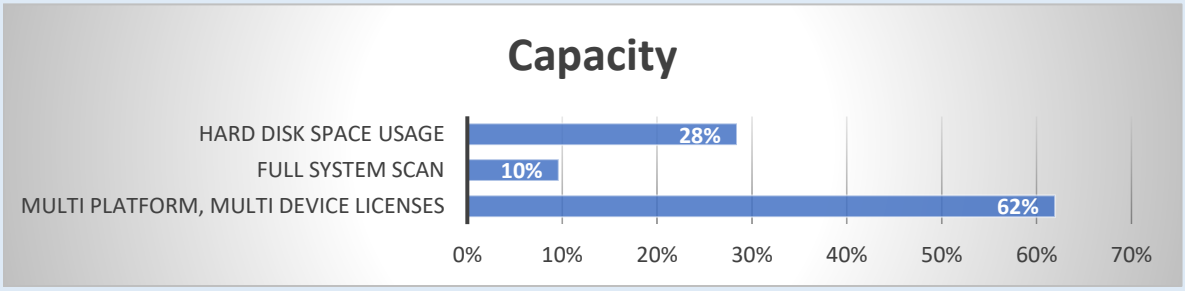
Capacity			
	Multi-Platform, Multi-device licenses	**Full System Scan**	**Hard disk space usage**
Multi-Platform, Multi-device licenses	1	5	3
Full System Scan	1/5	1	1/4
Hard disk space usage	1/3	4	1

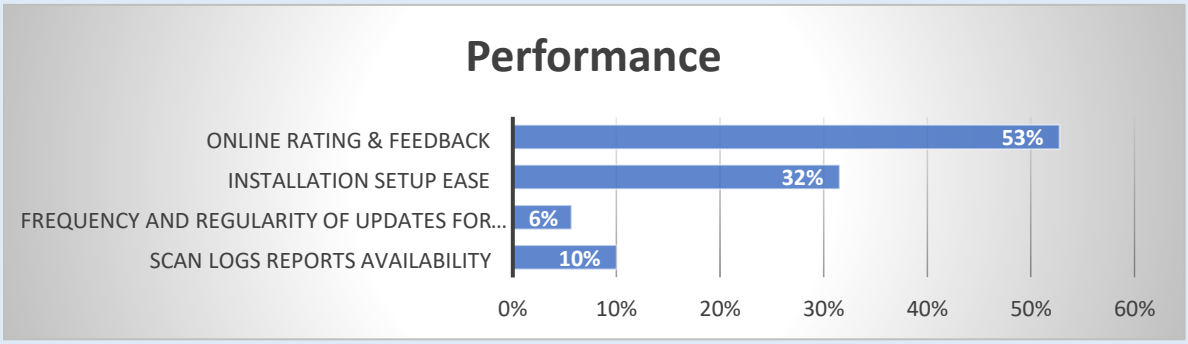
Performance				
	Scan logs reports availability	**Frequency and regularity of updates for software**	**Installation setup ease**	**Online rating & feedback**
Scan logs reports availability	1	3	1/5	1/7
Frequency and regularity of updates for software	1/3	1	1/5	1/7
Installation setup ease	5	5	1	1/2
Online rating & feedback	7	7	2	1

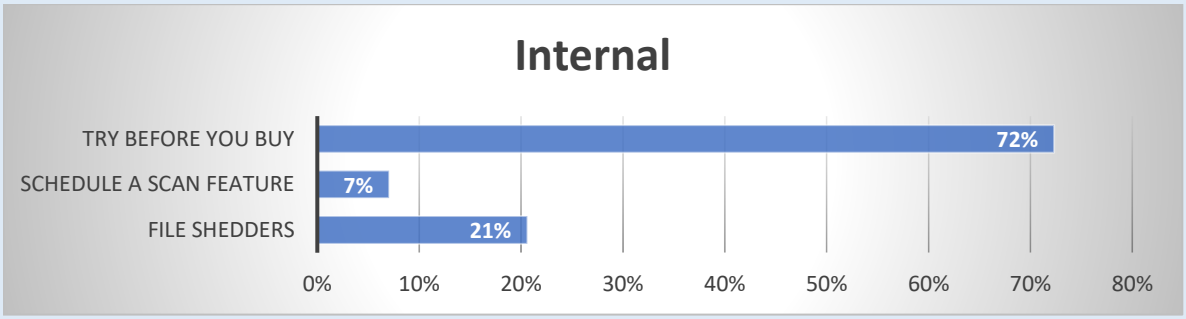
Internal			
	File Shedders	Schedule a scan feature	Try before you buy
File Shedders	1	4	1/5
Schedule a scan feature	1/4	1	1/8
Try before you buy	5	8	1

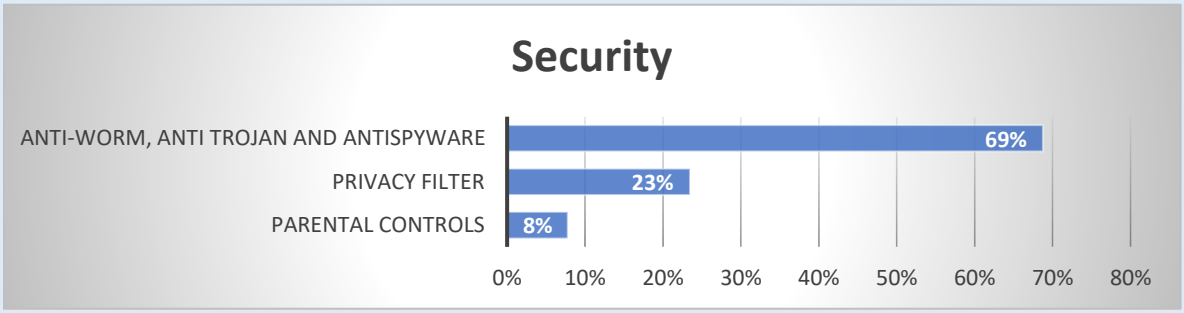
Security			
	Parental Controls	Privacy Filter	Anti-worm, Anti Trojan and Antispyware
Parental Controls	1	1/4	1/7
Privacy Filter	4	1	1/4
Anti-worm, Anti Trojan and Antispyware	7	4	1

The following charts demonstrate the priority results for the sub-criteria for each one of the criteria groups and their respective inconsistency indices. We can observe that none of the criteria demonstrates any inconsistency above the tolerable limits.









Step 6: The rating of each alternative is multiplied by the weights of the sub-criteria and aggregated to get local ratings with respect to each criterion.
With the help of IT Experts and AHP process we were able to calculate the criteria weights and evaluation concerns weights. Finally the bottom row weights were calculated.

Criteria	Weights of Criteria	Evaluation Concerns	Weights of Evaluation Concerns in its criteria (local ratings)	Bottom row weights overall
Capacity	17%	Multi-Platform, Multi device licenses	62%	11%
		Full System Scan	10%	2%
		Hard disk space usage	28%	5%
Performance	23%	Scan logs reports availability	10%	2%
		Frequency and regularity of updates for software	6%	1%
		Installation setup ease	32%	7%
		Online rating & feedback	53%	12%
Internal	13%	File Shedders	21%	3%
		Schedule a scan feature	7%	1%
		Try before you buy	72%	9%
Security	46%	Parental Controls	8%	4%
		Privacy Filter	23%	11%
		Anti-worm, Anti Trojan and Antispyware	69%	32%

10. Triangular Distribution

A triangular distribution (sometimes called a triangle distribution) is a continuous probability distribution shaped like a triangle. It is defined by:

- a: the minimum value, where a ≤ c,
- c: the peak value (the height of the triangle), where a ≤ c ≤ b,(most likely value) also called as mode.
- b: the maximum value, where b ≥ c.

For real time experience we took scan log from Symantec Anti-Virus software extracting log into a csv file. CSV file contains the details of start time of scan, end time of scan, logged by details, type of scan, scan status, Total files that got scanned, trusted files. Below is the snapshot of csv file of scan logs.

Started On	Completed	Logged By	Scan Type	Computer	Status	Total Files	Infected	Trusted
4/20/2019 15:33	4/20/2019 16:21	Scheduled scan	Active Scan	LAPTOP-CIEH6GCK	Scan Complete	1328	0	1298
4/20/2019 16:21	4/20/2019 23:38	Scheduled scan	Full Scan	LAPTOP-CIEH6GCK	Scan Complete	2023570	0	55669
4/20/2019 23:38	4/20/2019 23:40	Defwatch QuickScar	Active Scan	LAPTOP-CIEH6GCK	Scan Complete	913	0	902
4/20/2019 23:40	4/20/2019 23:45	Scheduled scan	Active Scan	LAPTOP-CIEH6GCK	Scan Complete	946	0	873
4/21/2019 12:00		Scheduled scan	Full Scan	LAPTOP-CIEH6GCK	Scan Delayed	0	0	0
4/21/2019 16:07	4/21/2019 16:11	Defwatch QuickScar	Active Scan	LAPTOP-CIEH6GCK	Scan Complete	902	0	873
4/21/2019 21:29	4/21/2019 21:35	Scheduled scan	Active Scan	LAPTOP-CIEH6GCK	Scan Complete	908	0	864
4/22/2019 11:03	4/22/2019 11:20	Defwatch QuickScar	Active Scan	LAPTOP-CIEH6GCK	Scan Complete	1280	0	1241

So, we created another column to calculate the time lapse for active scan to obtain that we filtered out “full scan” and considered “active scan” type. We ended up with a set of scan durations with minimum duration of 1min, maximum duration of 124min and with most likely duration of 5min (calculated by finding out mode of in that set). So, the basic triangular plot is depicted by following chart.

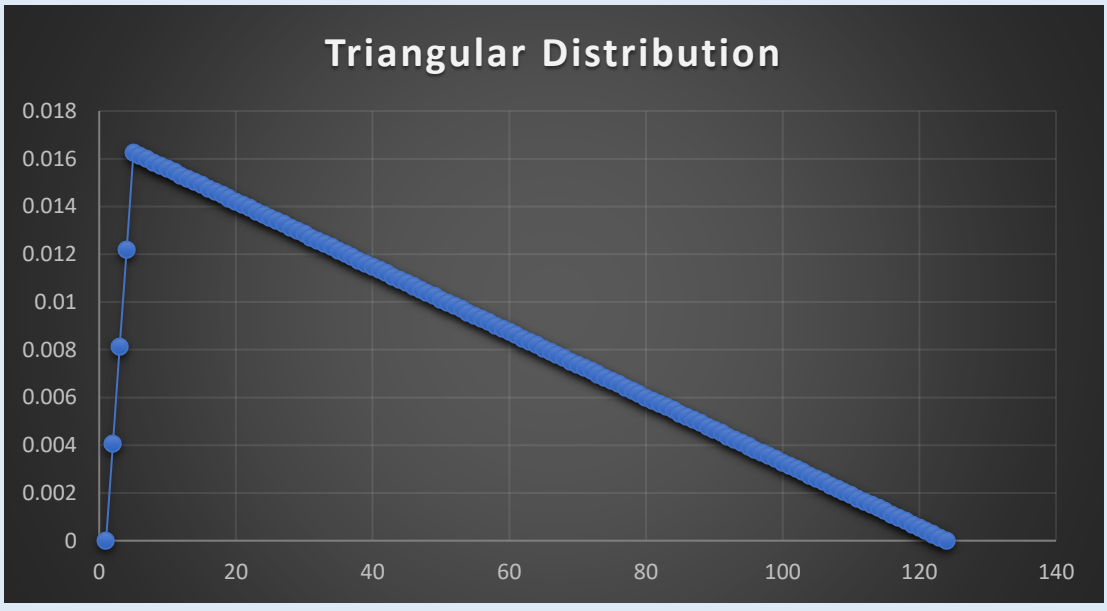
a -> 1min, c -> 5mins, b->124mins

mean = $\frac{\min + \text{mode} + \max}{3} = \frac{a+b+c}{3}$

Var = $\frac{a^2+b^2+c^2-a*b-b*c-c*a}{18}$

Peak value of mode ‘c’ is achieved at $\frac{2}{(b-a)}$ which is 0.01626.

It is a positively skewed triangular distribution.



To fit the triangular distributed model, we build histogram by following the below method.

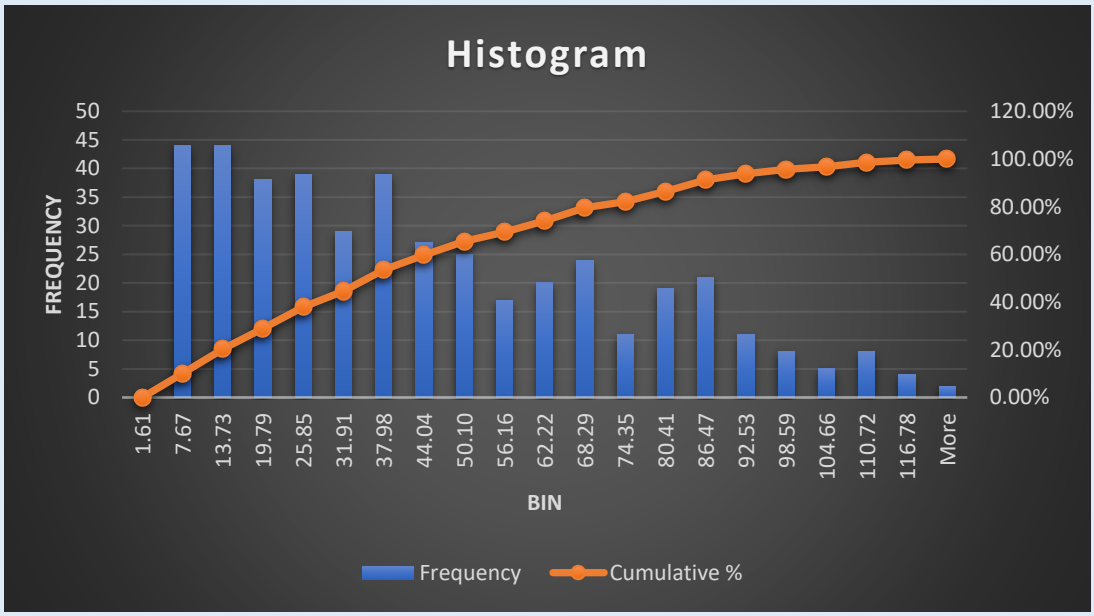
Assume a variable ‘u’ being the random variable ranging from 0 to 1. Checking if the variable is less than or equal to $\frac{(c-a)}{(b-a)}$.

If yes, the calculate the $x = a + \sqrt{(b-a)(c-a)u}$

else calculate value of x by

$x = b - \sqrt{(b-c)(b-a)(1-u)}$

After 434 simulations that will fit the triangular distributions the following chart of histogram is obtained.



From the above chart we can observe that the histogram is distributed as positively skewed manner. Entire process of triangular distribution model was carried out in excel sheets.

11. Identifying Alternatives

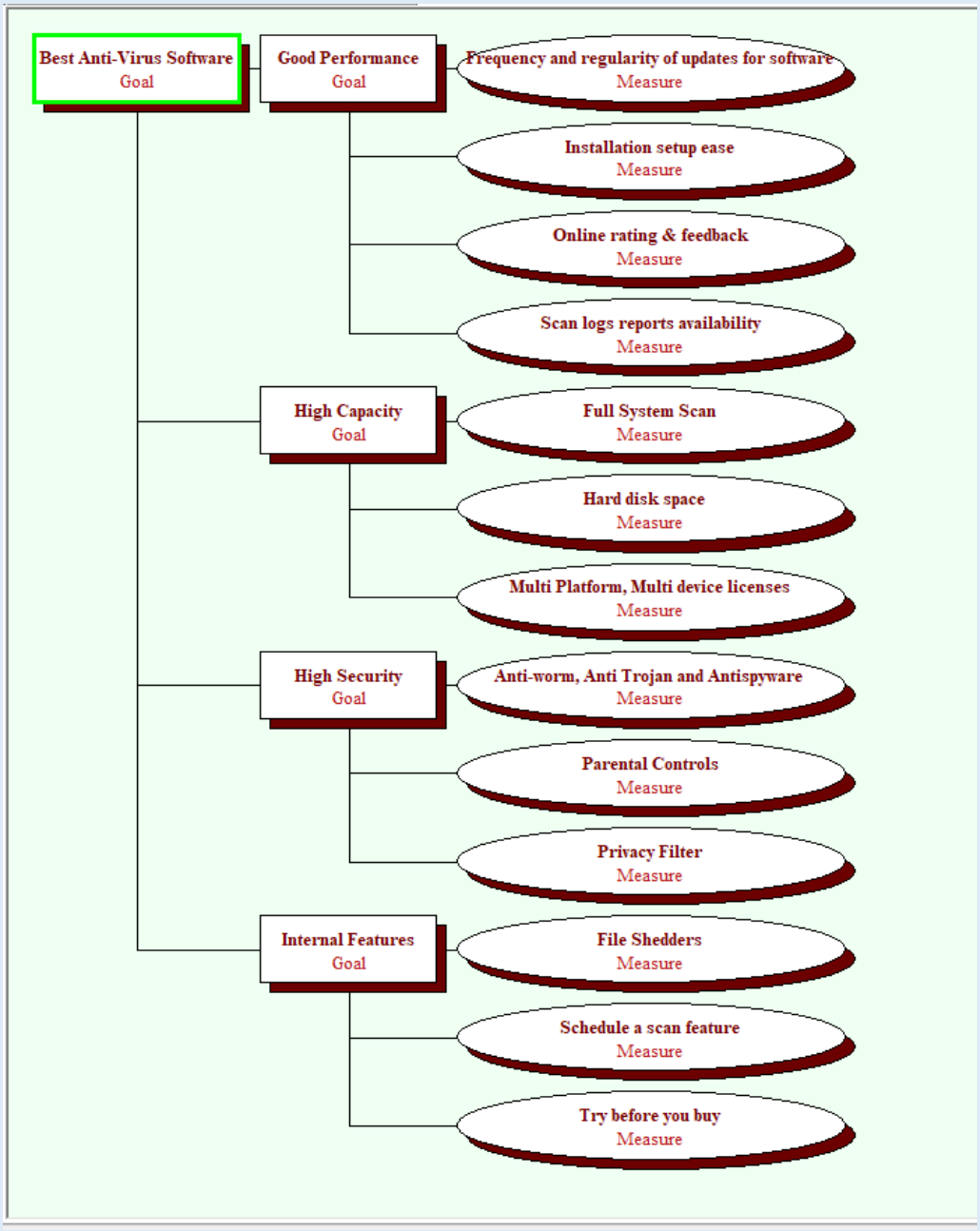
We decided to choose 4 current top anti-virus software as alternatives which are Symantec end point encryption, Kaspersky, Windows Defender (Pre-Installed), Bitdefender Internet Security. The reason we chose this anti-virus software as alternatives is that Symantec is GMU licensed Anti-Virus software, which is free for students, Windows defender is the default windows anti-virus software, Kaspersky and Bit Defender are top two anti-virus software. Based on the evaluation concern's measurement analysis values were given to the anti-virus software. Hard disk space and Installation setup ease were rated and compared online for all the anti-virus software available.

Alternatives	Symantec end point encryption	Kaspersky	Windows Defender (Pre-Installed)	Bitdefender Internet Security
Multi-Platform, Multi device licenses	1	1	0	1
Full System Scan	1	1	1	1
Hard disk space	Moderate	Moderate	Moderate	Low
File Shedders	1	1	0	1
Schedule a scan feature	1	1	1	1
Try before you buy	2	2	99999	6
Scan logs reports availability	1	1	1	1
Frequency and regularity of updates for software	1	1	0	1
Installation setup ease	Moderate	Moderate	Low	Moderate
Online rating & feedback	2	2	3	3
Parental Controls	0	1	1	1
Privacy Filter	0	1	0	1
Anti-worm, Anti Trojan and Antispyware	99.98%	99.88%	99.98%	99.99%

12. Goal Hierarchy Diagram

The tool used is Logical Decision for Windows and it can be used to rank the alternatives by evaluating the measures and goals given by the user. The steps used to make the ldw diagram are as follows :

1. Created and organized the objectives(goals).
2. Defined the measures and placed under the appropriate goals and assigned ranges for the numerical variables.
3. Built goal hierarchy and then assigned calculated weights to the factors and variables.



Goal Hierarchy Diagram

13. Alternatives Ranking

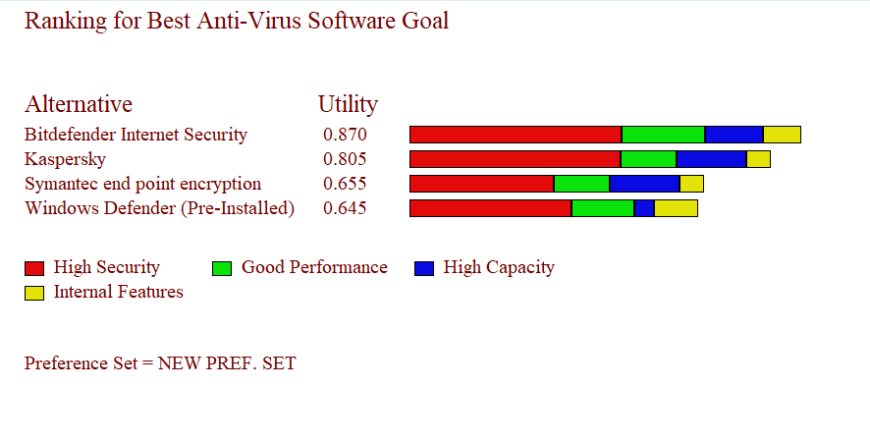
Generated Results Matrix to rank the alternatives.

	Best Anti-Virus Software Goal	High Security Goal	Anti-worm, Anti Trojan and Antispyware Measure	Good Performance Goal	High Capacity Goal	Internal Features Goal
Weight	1.000	0.470	0.320	0.220	0.180	0.130
Bitdefender Internet Security	0.870	1.000	1.000	0.841	0.722	0.654
Kaspersky	0.805	0.999	0.999	0.568	0.861	0.423
Symantec end point encryption	0.655	0.681	1.000	0.568	0.861	0.423
Windows Defender (Pre-Installed)	0.645	0.766	1.000	0.636	0.250	0.769

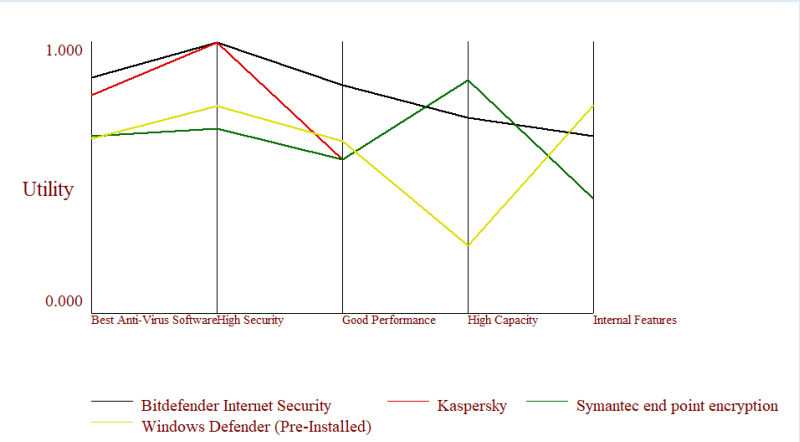
The type of ranking method we used is “Direct Entry Ranking” method. The reason we used “direct entry” method is we already have the weights calculated with the help of IT Experts. So after feeding the weights to all the evaluation concerns and evaluating the result we got the following ranks for the alternatives:

1. Bitdefender Internet Security- 87%
2. Kaspersky- 80.5%
3. Symantec End Point Encryption- 65.5%
4. Windows Defender(Pre-Installed)- 64.5%

The below diagram also gives how much each individual goal is affecting the ranking of each alternative. Security plays a very important role in how an alternative is selected.



Ranking of the alternatives based on the individual goals.



14.FINAL DECISION BY DECISION MAKER

After presenting the calculated ranks from all the alternatives we inferred that ""Bitdefender Internet Security" Anti- virus software stands out as the best possible solution for the decision maker who has no technical background.

The decision maker opted to choose the suggested software as firstly, it had a free trial version for 6 months and also this ranked best among all the other available options in the market.

References

[1] D. K. Devi, Dr. K. M. Kumar, An Analysis of Various Anti-Virus Software Tools Based On Different Effective Parameters. ijcstjournal, 4(4) (2016)

[2] T. Saaty. Decision making with the Analytic Hierarchy Process. Int. J. Services Sciences Int. J. Services Sciences (2008)

[3] Craig W. Kirkwood, Strategic Decision Making-Multiobjective Decision Analysis with Spreadsheets, Multiobjective Value Analysis(1997)

[4] SPSS Factor Analysis – Beginners Tutorial, last updated on September 2018,https://www.spss-tutorials.com/spss-factor-analysis-tutorial/#spss-factor-analysis-output

[5] AV Comparatives- Test Results, last updated on April 2019,https://www.av-comparatives.org/test-results/

[6] AV Comparatives- Malware Protection Test March 2019, last updated on March 2019, https://www.av-comparatives.org/tests/malware-protection-test-march-2019/

APPENDIX

Data collection survey to build a Decision model for ANTIVIRUS SOFTWARE selection

Thank you for participating in our Survey :)

We are glad that your response will be contributing data to build the decision model which benefit common people to make a better decision for selecting antivirus software.

There are a lot of factors to consider when you're trying to select the best antivirus solution for your requirements. With the security of your data, digital identity and financial transactions at stake, We believe it's worthwhile investing some time in building a decision model

* Required

1. **Name** *

_____

TL;DR Please fill this quick survey and let us know your thoughts (your answers will be anonymous).

2. **Do you have an antivirus software installed on your personal computer?** *
   Mark only one oval.

   - ◯ Yes
   - ◯ No
   - ◯ I use the default Windows defender.
   - ◯ Other: _____

Please choose the appropriate option to rate the factors that you will consider to determine antivirus software selection.

1 = Least significant 5 = Extremely significant

3. **Online rating & feedback** *
   Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

4. **Hard disk space usage** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

5. **Customer care service** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

6. **Schedule a scan feature** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

7. **Scan logs reports availability** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

8. **Multiplatform, multi device licenses** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

9. **Try before you buy option (try a month for free)** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

10. **Malware detection rate** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

11. **Privacy Filter (If you're about to inadvertently divulge personal information, a privacy filter will provide a warning)** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

12. **Parental controls (block access to certain sites unsuitable for children)** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

13. **File Shredders (remove all electronic traces of infected file)** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

14. **Spam Filters** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

15. **Frequency and regularity of updates for software** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

16. **Installation setup ease** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

17. **No excessive memory use (A light touch that won't slow you down.)** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

18. **Anti-worm, Anti Trojan and Antispyware** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

19. **Full System Scan (Checks all boot records, files, and running processes)** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

20. **Subscription Price** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

21. **Data and identity protection** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

22. **Scan speed and accuracy** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

23. **User friendly (See how easy the software is to use)** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

24. **Internet security** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

25. **Loading speed** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

26. **Any other valuable inputs or evaluation concern areas that you would want us to consider for antivirus software selection process? (optional)**

Thank you for the information.

This survey is a part of decision and risk analysis project .

SPSS Output

```
FACTOR
  /VARIABLES HDSU SLRA SSF MM TBY FS PC PF FSSCAN ANTI FREQ INST ORFB
  /MISSING LISTWISE
  /ANALYSIS HDSU SLRA SSF MM TBY FS PC PF FSSCAN ANTI FREQ INST ORFB
  /PRINT UNIVARIATE INITIAL CORRELATION SIG DET KMO INV EXTRACTION ROTATION
FSCORE
  /FORMAT SORT
  /PLOT EIGEN ROTATION
  /CRITERIA MINEIGEN(1) ITERATE(25)
  /EXTRACTION PC
  /CRITERIA ITERATE(25)
  /ROTATION VARIMAX
  /SAVE REG(ALL)
  /METHOD=CORRELATION.
```

Factor Analysis

Notes

Output Created		04-MAY-2019 23:33:35
Comments		
Input	Data	C:\Users\lsrli\Desktop\gmu\syst 573\PROJECT.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	51
Missig Value Handling	Definition of Missing	MISSING=EXCLUDE: User-defined missing values are treated as missing.
	Cases Used	LISTWISE: Statistics are based on cases with no missing values for any variable used.

Syntax		FACTOR /VARIABLES HDSU SLRA SSF MM TBY FS PC PF FSSCAN ANTI FREQ INST ORFB /MISSING LISTWISE /ANALYSIS HDSU SLRA SSF MM TBY FS PC PF FSSCAN ANTI FREQ INST ORFB /PRINT UNIVARIATE INITIAL CORRELATION SIG DET KMO INV EXTRACTION ROTATION FSCORE /FORMAT SORT /PLOT EIGEN ROTATION /CRITERIA MINEIGEN(1) ITERATE(25) /EXTRACTION PC /CRITERIA ITERATE(25) /ROTATION VARIMAX /SAVE REG(ALL) /METHOD=CORRELATION.
Resources	Processor Time	00:00:00.81
	Elapsed Time	00:00:00.51
	Maximum Memory Required	23424 (22.875K) bytes
Variables Created	FAC1_1	Component score 1
	FAC2_1	Component score 2
	FAC3_1	Component score 3
	FAC4_1	Component score 4

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
HDSU	3.8235	1.12616	51
SLRA	4.0588	.90359	51
SSF	3.8431	1.06532	51
MM	3.8039	1.14925	51
TBY	4.1569	1.04638	51
FS	4.0588	1.22330	51
PC	3.8431	1.33225	51
PF	4.0196	1.08610	51
FSSCAN	4.2549	.84482	51
ANTI	4.2941	.85543	51
FREQ	3.9216	.93473	51
INST	4.0980	1.08176	51
ORFB	3.9412	1.02785	51

Correlation Matrix

		HDSU	SLRA	SSF	MM	TBY	FS							
Correlation	HDSU	1.000	.207	.243	.344	.143	.240							
	SLRA	.207	1.000	.508	.319	.075	.540							
	SSF	.243	.508	1.000	.481	-.121	.498							
	MM	.344	.319	.481	1.000	.109	.492							
	TBY	.143	.075	-.121	.109	1.000	.102							
	FS	.240	.540	.498	.492	.102	1.000							
	PC	.248	.473	.377	.528	.090	.693							
	PF	.117	.447	.297	.292	.244	.631							
	FSSCAN	.300	.242	.001	.114	.565	.275							
	ANTI	.159	.288	.205	.141	.461	.423							
	FREQ	.139	.455	.329	.227	.033	.371							
	INST	.294	.240	.031	-.016	.251	.177							
	ORFB	.354	.198	.119	.193	.195	.146							
Sig. (1-tailed)	HDSU		.073	.043	.007	.159	.045							
	SLRA	.073		.000	.011	.301	.000							
	SSF	.043	.000		.000	.199	.000							
	MM	.007	.011	.000		.223	.000							

Inverse of Correlation Matrix

	HDSU	SLRA	SSF	MM	TBY	FS	PC	PF
HDSU	1.579	.020	-.310	-.469	.195	-.070	.103	-.026
SLRA	.020	1.882	-.616	.199	-.140	-.346	-.273	-.253
SSF	-.310	-.616	1.953	-.489	.233	-.371	.113	.079
MM	-.469	.199	-.489	2.079	-.586	-.336	-.962	.407
TBY	.195	-.140	.233	-.586	1.961	.192	.420	-.419
FS	-.070	-.346	-.371	-.336	.192	2.780	-.905	-.661
PC	.103	-.273	.113	-.962	.420	-.905	2.800	-.988
PF	-.026	-.253	.079	.407	-.419	-.661	-.988	2.293
FSSCAN	-.596	-.135	.534	.239	-.916	-.054	-.152	.086
ANTI	.334	.349	-.483	.216	-.433	-.450	.110	-.445
FREQ	.496	-.478	-.297	-.635	.879	-.055	.590	-.300
INST	-.675	-.053	.312	.749	-.611	.077	-.877	.670
ORFB	-.351	-.170	.042	-.142	-.002	.079	.111	.009

TBY	.159	.301	.199	.223		.238
FS	.045	.000	.000	.000	.238	
PC	.040	.000	.003	.000	.266	.000
PF	.206	.001	.017	.019	.042	.000
FSSCAN	.016	.044	.498	.212	.000	.025
ANTI	.133	.020	.074	.161	.000	.001
FREQ	.166	.000	.009	.054	.408	.004
INST	.018	.045	.415	.455	.038	.107
ORFB	.005	.082	.202	.087	.085	.153

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.721
Bartlett's Test of Sphericity	Approx. Chi-Square	262.994
	df	78
	Sig.	.000

Communalities

	Initial	Extraction
HDSU	1.000	.700
SLRA	1.000	.579
SSF	1.000	.636
MM	1.000	.643
TBY	1.000	.732
FS	1.000	.767
PC	1.000	.680
PF	1.000	.741
FSSCAN	1.000	.763
ANTI	1.000	.729
FREQ	1.000	.801
INST	1.000	.726
ORFB	1.000	.561

Extraction Method: Principal Component Analysis.

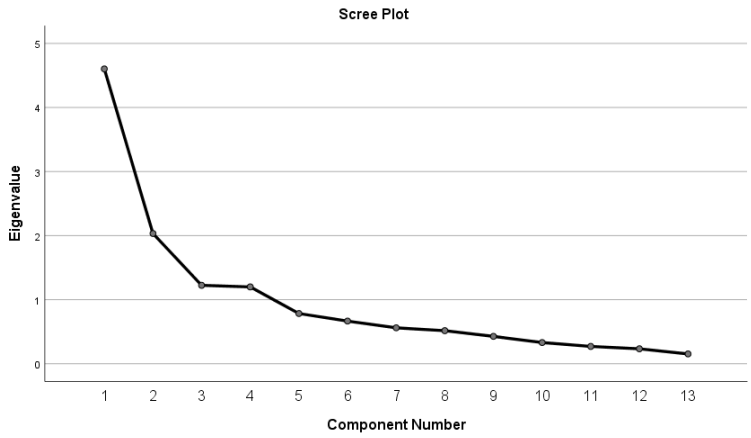
Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings					
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %			
1	4.602	35.403	35.403	4.602	35.403	35.403			
2	2.033	15.638	51.041	2.033	15.638	51.041			
3	1.224	9.415	60.457	1.224	9.415	60.457			
4	1.199	9.225	69.682	1.199	9.225	69.682			
5	.784	6.030	75.711						
6	.666	5.121	80.833						
7	.561	4.313	85.146						
8	.516	3.969	89.115						
9	.427	3.288	92.403						
10	.331	2.544	94.947						
11	.270	2.078	97.025						
12	.233	1.796	98.821						
13	.153	1.179	100.000						

v

Component Matrix[a]

	Component			
	1	2	3	4
FS	.783	-.335	-.120	-.165
PC	.721	-.345	-.076	-.188
ANTI	.690	.452	-.197	-.102
PF	.685	-.153	-.241	-.437
SLRA	.683	-.256	-.132	.171
FREQ	.631	.134	-.327	.528
MM	.559	-.425	.371	-.110
SSF	.543	-.537	.074	.217
FSSCAN	.601	.617	.030	-.140
TBY	.359	.609	.114	-.469
HDSU	.448	.066	.665	.230
ORFB	.379	.239	.593	.094
INST	.469	.457	-.175	.517



Extraction Method: Principal Component Analysis.[a]

4 components extracted.

Rotated Component Matrix[a]

	Component			
	1	2	3	4
FS	.843	.173	.150	.054
PC	.803	.152	.086	.068
PF	.736	.424	.010	-.139
SSF	.675	-.295	.193	.236
MM	.657	-.036	-.123	.441
SLRA	.646	.000	.389	.105
TBY	-.008	.841	-.042	.150
FSSCAN	.104	.762	.343	.232
ANTI	.290	.668	.443	.044
FREQ	.311	.066	.836	.038
INST	-.023	.231	.805	.156
HDSU	.162	.064	.130	.808
ORFB	.045	.241	.084	.702

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.[a]

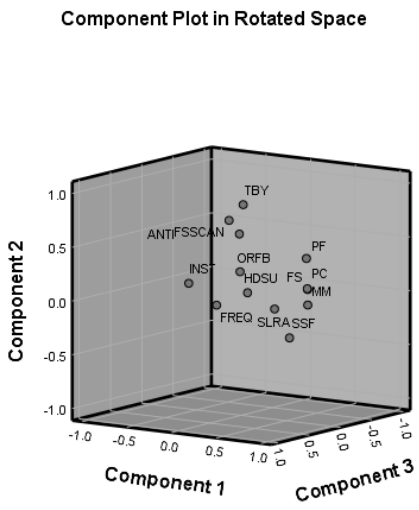
a. Rotation converged in 6 iterations.

Component Transformation Matrix

Component	1	2	3	4
1	.750	.401	.430	.302
2	-.608	.718	.326	.094
3	-.122	-.048	-.384	.914
4	-.229	-.567	.749	.254

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.



Component Score Coefficient Matrix

	Component			
	1	2	3	4
HDSU	-.057	-.073	-.013	.578
SLRA	.169	-.106	.171	-.030
SSF	.200	-.248	.077	.112
MM	.202	-.064	-.201	.271
TBY	-.046	.463	-.197	.037
FS	.271	.033	-.046	-.089
PC	.264	.033	-.082	-.065
PF	.265	.222	-.157	-.235
FSSCAN	-.063	.335	.058	.061
ANTI	.016	.276	.135	-.103
FREQ	-.005	-.134	.513	-.085
INST	-.141	-.036	.495	.031
ORFB	-.087	.049	-.054	.498

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Component Scores.

Component Score Covariance Matrix

Component	1	2	3	4
1	1.000	.000	.000	.000
2	.000	1.000	.000	.000
3	.000	.000	1.000	.000
4	.000	.000	.000	1.000

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Component Scores.

Factor Analysis

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
DATA	0.793	0.328	0.214	0.083	0.123	0.033
MDR	0.711	0.265	0.123	0.140	0.161	0.173
IS	0.682	0.336	0.200	0.053	0.515	0.094
SSA	0.650	0.403	0.154	0.049	0.438	0.125
SUBSPRICE	0.649	-0.088	0.406	0.258	0.237	0.053
ORFB	0.534	0.001	0.143	0.037	-0.136	0.527
FS	0.321	0.779	0.051	0.190	0.132	0.007
PC	0.056	0.775	0.172	0.121	0.148	0.096
PF	0.278	0.707	0.303	-0.005	0.189	-0.228
MM	-0.020	0.661	-0.019	-0.097	0.222	0.518
SLRA	0.304	0.600	-0.054	0.435	-0.168	0.131
SSF	0.259	0.559	-0.382	0.231	0.215	0.200
TBY	0.135	0.033	0.811	-0.020	-0.032	0.119
FSSCAN	0.295	0.111	0.723	0.288	0.125	0.145
ANTI	0.254	0.313	0.619	0.365	0.094	-0.058
INST	-0.015	-0.067	0.318	0.804	0.212	0.115
FREQ	0.142	0.304	0.089	0.762	0.080	-0.026
NEMU	0.466	0.086	0.435	0.484	0.166	0.288
CCS	0.451	0.353	-0.190	0.477	0.081	0.112
UF	0.172	0.114	-0.065	0.193	0.862	0.089
LS	0.336	0.391	0.199	0.109	0.607	0.257
SF	0.488	0.460	0.224	0.120	0.491	0.035
HDSU	0.155	0.090	0.136	0.143	0.220	0.780

x

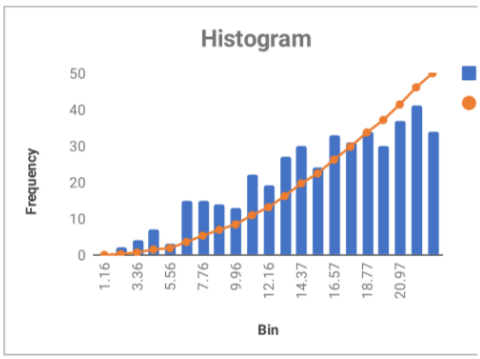
AHP-IT Expert Opinion

AHP:

n=	4				n	1	2	3	4	5	6	7	8	9	10
					RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49
	Security	performance	Capacity	Internal Features											
Security	1.00	3.06	2.91	2.16											
performance	0.33	1.00	1.82	2.05											
Capacity	0.34	0.55	1.00	1.93											
Internal Features	0.46	0.49	0.52	1.00											
Totals	2.13	5.10	6.25	7.14											
	Security	performance	Capacity	Internal Features		Criteria Weights									
Security	0.4688	0.6006	0.4661	0.3022		0.4594									
performance	0.1530	0.1960	0.2912	0.2869		0.2318									
Capacity	0.1609	0.1077	0.1600	0.2708		0.1748									
Internal Features	0.2173	0.0957	0.0827	0.1401		0.1340									
Criteria Weights	0.4594	0.2318	0.1748	0.1340											
	Security	performance	Capacity	Internal Features		Weighted Sum	Criteria Weights								
Security	0.46	0.71	0.51	0.29		1.97	0.4594	4.28373							
performance	0.15	0.23	0.32	0.27		0.97	0.2318	4.20388							
Capacity	0.16	0.13	0.17	0.26		0.72	0.1748	4.11137							
Internal Features	0.21	0.11	0.09	0.13		0.55	0.1340	4.10968							
							lambda m	4.17716							
						Consistency Index		0.05905							
						Consistency Ratio		0.06562	<	0.1					
									WE CONSIDER THIS FOR FURTHER PROCESS						

Uncertainity example

Bin	*Frequency*	*Cumulative %*
1.16	0	0.00%
2.26	2	0.46%
3.36	4	1.38%
4.46	7	2.99%
5.56	3	3.68%
6.66	15	7.13%
7.76	15	10.57%
8.86	14	13.79%
9.96	13	16.78%
11.06	22	21.84%
12.16	19	26.21%
13.26	27	32.41%
14.37	30	39.31%
15.47	24	44.83%
16.57	33	52.41%
17.67	31	59.54%
18.77	34	67.36%
19.87	30	74.25%
20.97	37	82.76%
22.07	41	92.18%
More	34	100.00%



Alternatives

Alternatives	Symantec end point encryption	Kaspersky	Windows Defender (Pre-Installed)	Bitdefender Internet Security
Multi Platform, Multi device licenses	1	1	0	1
Full System Scan	1	1	1	1
Hard disk space	Moderate	Moderate	Moderate	Low
File Shedders	1	1	0	1
Schedule a scan feature	1	1	1	1
Try before you buy	2	2	99999	6
Scan logs reports availability	1	1	1	1
Frequency and regularity of updates for software	1	1	0	1
Installation setup ease	Moderate	Moderate	Low	Moderate
Online rating & feedback	2	2	3	3
Parental Controls	0	1	1	1
Privacy Filter	0	1	0	1
Anti-worm, Anti Trojan and Antispyware	99.98%	99.88%	99.98%	99.99%