Choosing the Best Anti-Virus in the World by Application of TOPSIS Method

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Abstract: Decision making problem is the process of finding the best option from all of the feasible alternatives. Due to the fact that, the collected data for choosing an anti-virus isn’t concrete and substantial the way users demand including the risk attitude for a decision maker which is somehow unknown, and considering the increase in the complexity and the variety of decision making problems, the methods of decision making become more varied and will have more capability of problem solving. We present a new TOPSIS method for normalizing the collected data and ranking the alternatives, a multi-attribute decision making (MADM) technique for ranking and selection of a number of externally determined alternatives through distance measures. A Technique for Order Preference by Similarity to Ideal Solution method is a multiple criteria method to identify solution from finite set of points and by eliminating the units of criterion functions and determining a solution with the shortest distance to the ideal solution and the greatest distance from the negative-ideal one. For this research some of these criteria considered are "Detection and Missed Samples", "False Positive/Alarm", "Scanning Speed", "Encoding and transcoding" and so on. [Hesam Naie, Kaveh Teymournejad. Choosing the Best Anti-Virus in the World by Application of TOPSIS Method. Life Sci J 2012;9(4):5082-5090] (ISSN: 1097-8135). http://www.lifesciencesite.com. 758

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1. Introduction

The Anti-Virus (Post and Kagan, 1998) secures the computers by observing and reviewing files contents (Post and Kievit, 1991). If it observes viruses prevents them from entering into your computer and/or executing, by giving you a warning and asking you for command of deletion and taking your precautionary measures. But one of the foremost concerns for those, who work with computer, is to select and install a safe and secure anti-virus for protection of their computers. Computer viruses are developed every day and to prevent them to ruin the existing files seems to be inevitable. Therefore, the applications of anti-viruses are growing more than ever. However, if you observe the anti-viruses market, you will be certainly shocked by seeing a large numbers of anti-viruses brands, consequently this may cause the problem for selecting a suitable anti-viruses. The fact is every one considers certain criteria to select safe anti-virus. Therefore, we should notice this important point that there is no perfect anti-virus and that we should always keep checking and testing the installed security software on our systems.

Computer viruses have been extensively studied by many authors (Cohen, 1990). In 1984, Fredrick B. Cohen (Cohen, 1987) purposed term Computer Virus. Computer viruses are those programs, which are spread like biologic viruses and execute unexpected measures when they enter into computers. Despite the fact that all viruses are not dangerous, most of them have been written with the aim of destruction of certain types of files, application programs and/or operating systems. Like all other programs, viruses are benefited from system sources such as memory and hard disk space, CPU power and other sources. They can do dangerous actions, for instance, they may damage the computer systems erasing data, stealing information or modifying the normal operation (Jose et al., 2008). Also, a virus may provide license of access to the device via network or without identification.

The functions of existing anti-virus are not the same. Such anti-virus covers the files and/or its memory in order to review the existing certain virus signatures, which may contaminate the system. Anti-viruses are seeking for the virus signatures based on certain signs, definitions and/or identified of viruses. The computer viruses programmer always writes new computer viruses and updates their former written ones. Therefore, it always requires updating the information bank including definitions and computer virus signatures relating to the given software. After installation of the anti-virus on your computer, you may do scan and review the system in order to identify the existing virus at certain time intervals or period (Naie et al., 2011).

Performance of anti-viruses is also reviewed based on criteria and by using TOPSIS method where these criteria are main parameters for comparison and evaluation of anti-viruses against types of viruses and internet worms as well as spywares and malwares.
Multiple criteria decision making (MCDM) is the tool most frequently used to deal with conflict management (Fu et al., 2007; Shi et al., 2005). Practical problems are often characterized by several non-commensurable and conflicting (competing) criteria, and there may be no solution satisfying all criteria simultaneously. Therefore, the solution is a set of non-inferior solutions, or a compromise solution according to the decision makers’ preference. A compromise solution for a problem with conflict criteria can allow the decision makers to reach a final decision. The foundation for compromise solutions was established by Yu (1973) and Zeleny (1982), and other distance-based techniques have also been developed (Chen and Hwang, 1992). The compromise solution is a feasible solution closest to the ideal/aspired level and a compromise means an agreement established by mutual concessions.

The TOPSIS (technique for order performance by similarity to ideal solution) was first developed by Hwang & Yoon (1981). According to this technique, the best alternative would be the one that is nearest to the positive-ideal solution and farthest from the negative ideal solution (Ertugrul & Karakasoglu, 2007). The positive-ideal solution is a solution that maximizes the benefit criteria and minimizes the cost criteria, whereas the negative ideal solution maximizes the cost criteria and minimizes the benefit criteria (Wang & Elhag, 2006). In short, the positive-ideal solution is composed of all best values attainable from the criteria, whereas the negative ideal solution consists of all worst values attainable from the criteria (Wang, 2007). Interested readers can check the contents of Shih et al. (2007) for more details of TOPSIS and There have been lots of studies in the literature using TOPSIS for the solution of MCDM problems. (Chen, 2000; Chu, 2002; Chu & Lin, 2002; Lai, Liu, & Hwang, 1994; Wang et al., 2005).

In this article, we have tried to select the best anti-viruses from 20 globally introduced anti-viruses by using TOPSIS method. The existing lists comprise names of anti-viruses in alphabetic order (On-Demand Comparative; 2011, Performance Test, 2011).

The used test-set contain about 200 thousands recent/prevalent malware sample from last months and consists of: (On-Demand Comparative, 2011).

- WINDOWS : Windows XP service pack 3
- CPU : Intel Core 2 Duo E8300/2.83 GHz
- RAM : 2 GB Ram

#### Table 1: 20 globally introduced anti-virus software

<table>
<thead>
<tr>
<th>Anti-Virus</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avast! Free Antivirus 6.0</td>
<td>6.0.1203</td>
</tr>
<tr>
<td>AVG Anti-Virus 2012</td>
<td>10.0.1392</td>
</tr>
<tr>
<td>AVIRA Free Antivirus 2012</td>
<td>10.2.0.700</td>
</tr>
<tr>
<td>Bitdefender Antivirus Plus 2012</td>
<td>15.0.27.319</td>
</tr>
<tr>
<td>eScan Anti-Virus 11</td>
<td>11.0.1139.998</td>
</tr>
<tr>
<td>ESET NOD32 Antivirus 5</td>
<td>5.0.90.0</td>
</tr>
<tr>
<td>F-Secure Anti-Virus 2012</td>
<td>10.51.106</td>
</tr>
<tr>
<td>G DATA Antivirus 2012</td>
<td>22.0.2.32</td>
</tr>
<tr>
<td>K7 Antivirus Plus 11.1</td>
<td>11.1.0050</td>
</tr>
<tr>
<td>Kaspersky Anti-Virus 2012</td>
<td>12.0.0.374</td>
</tr>
<tr>
<td>McAfee Antivirus Plus 2012</td>
<td>15.0.291</td>
</tr>
<tr>
<td>Microsoft Security Essentials 2.1</td>
<td>2.1.1116.0</td>
</tr>
<tr>
<td>Panda Cloud Antivirus Free 1.5.1</td>
<td>1.5.1</td>
</tr>
<tr>
<td>PC Tools Spyware Doctor with Antivirus 2012</td>
<td>8.0.0.655</td>
</tr>
<tr>
<td>Qihoo 360 Antivirus 2.0</td>
<td>2.0.1.1332</td>
</tr>
<tr>
<td>Sophos Endpoint Security 9.7</td>
<td>9.7.4</td>
</tr>
<tr>
<td>Symantec Norton Antivirus 2012</td>
<td>19.1.0.21</td>
</tr>
<tr>
<td>Trend Micro Titanium Antivirus Plus 2012</td>
<td>2012</td>
</tr>
<tr>
<td>TrustPort Antivirus 2012</td>
<td>10.0.0.4796</td>
</tr>
<tr>
<td>Webroot Secure Anywhere Antivirus 2012</td>
<td>7.0.11.25</td>
</tr>
</tbody>
</table>

![Diagram of computer destructive codes and anti-viruses](image)

#### Figure 1. Diagram of computer destructive codes and anti-viruses

2. Method

Decision-making problem is the process of finding the best option from all of the feasible alternatives. In almost all such problems the multiplicity of criteria for judging the alternatives is pervasive. That is, for many such problems, the decision maker wants to solve a multiple criteria decision making (MCDM) problem. Multiple criteria decision making may be considered as a complex and
dynamic process including one managerial level and one engineering level (Duckstein & Opricovic, 1980). The managerial level defines the goals, and chooses the final "optimal" alternative. The multi-criteria nature of decisions is emphasized at this managerial level, at which public officials called "decision makers" have the power to accept or reject the solution proposed by the engineering level. These decision makers, who provide the preference structure, are "off line" from the optimization procedure done at the engineering level. A MCDM problem can be concisely expressed in matrix format as

\[
W = [w_1; w_2; \ldots; w_n]
\]

Where \( A_1, A_2, \ldots, A_m \) are possible alternatives among which decision makers have to choose, \( C_1, C_2, \ldots, C_n \) are criteria with which alternative performance are measured, \( x_{ij} \) is the rating of alternative \( A_i \) with respect to criterion \( C_j \), \( w_j \) is the weight of criterion \( C_j \). The main steps of multiple criteria decision making are the following:

(a) Establishing system evaluation criteria that relate system capabilities to goals.
(b) Developing alternative systems for attaining the goals (generating alternatives).
(c) Evaluating alternatives in terms of criteria (the values of the criterion functions).
(d) Applying a normative multi-criteria analysis method.
(e) Accepting one alternative as "optimal" (preferred).
(f) If the final solution is not accepted, gather new information and go into the next iteration of multi-criteria optimization.

Steps (a) and (e) are performed at the upper level, where decision makers have the central role, and the other steps are mostly engineering tasks. For step (d), a decision maker should express his/her preferences in terms of the relative importance of criteria, and one approach is to introduce criteria weights. This weights in MCDM do not have a clear economic significance, but their use provides the opportunity to model the actual aspects of decision making (the preference structure). In classical MCDM methods, the ratings and the weights of the criteria are known precisely (Fishburn et al., 1992). A survey of the methods has been presented Hwang and Yoon (1981). Technique for order performance by similarity to ideal solution (TOPSIS) (Lai et al., 1994), one of known classical MCDM method, was first developed by Hwang and Yoon (1981).

TOPSIS method is a technique for order preference by similarity to ideal solution that maximizes the benefit criteria/attributes and minimizes the cost criteria/attributes, whereas the negative ideal solution maximizes the cost criteria/attributes and minimizes the benefit criteria/attributes. The best alternative is the one, which is closest to the ideal solution and farthest from the negative ideal solution. Suppose a MCDM problem has \( n \) alternatives, \( A_1, A_2, \ldots, A_n \), and \( m \) decision criteria/attributes, \( C_1, C_2, \ldots, C_m \). Each alternative is evaluated with respect to the \( m \) criteria/attributes. Each value assigned to each alternative with respect to each criterion form a decision matrix denoted by \( X = (x_{ij})^{n \times m} \) as below:

\[
X = \begin{bmatrix}
[x_{11} & x_{12} & \cdots & x_{1m} \\
[x_{21} & x_{22} & \cdots & x_{2m} \\
\vdots & \vdots & \ddots & \vdots \\
[x_{n1} & x_{n2} & \cdots & x_{nm}]
\end{bmatrix}
\]

(1)

Let \( W = (w_1, w_2, \ldots, w_m) \) be the relative weight vector about the criteria, satisfying \( \sum_{j=1}^{m} w_j = 1 \). Then the procedure of TOPSIS can be expressed in a series of steps:

Step 1. Calculate the normalized decision matrix. Some normalized methods for TOPSIS are summarized by Shih et al. (2007). For simplify, a vector normalization method is introduced whose normalized value \( n_{ij} \) is calculated as:

\[
n_{ij} = \frac{x_{ij}}{\sqrt{\sum_{k=1}^{m} x_{kj}^2}} \quad i = 1,2,\ldots,n \quad j = 1,2,\ldots,m
\]

(2)

Step 2. Calculate the weighted normalized decision matrix \( V = (v_{ij})^{n \times m} \):

\[
v_{ij} = w_j n_{ij} \quad i = 1,2,\ldots,n \quad j = 1,2,\ldots,m
\]

(3)

Where \( w_j \) is the relative weight of the \( j \)-th criterion/attribute, and \( \sum_{j=1}^{m} w_j = 1 \).

Step 3. Determine the positive ideal \( A^+ \) and negative ideal solution \( A^- \) as below

\[
A^+ = \{ v_1^+, v_2^+, \ldots, v_m^+ \} = \{(\max_i v_{ij} | j \in \Omega_b) , (\min_i v_{ij} | j \in \Omega_c) \}
\]

(4)

\[
A^- = \{ v_1^-, v_2^-, \ldots, v_m^- \} = \{(\min_i v_{ij} | j \in \Omega_b) , (\max_i v_{ij} | j \in \Omega_c) \}
\]

(5)

Where \( \Omega_b \) is associated with benefit criteria, and \( \Omega_c \) is associated with cost criteria.

Step 4. Calculate the separation measures, using the \( m \)-dimensional Euclidean distance. The separation of each alternative from the ideal solution (\( A^+ \)) and the
negative ideal solution ($A^-$) are given as below, respectively:

$$D^{*}_i = \left( \sum_{j=1}^{m} (v_{ij} - v_{ij}^-)^2 \right)_{i = 1, 2, \ldots, n} \quad (6)$$

$$D_i^- = \left( \sum_{j=1}^{m} (v_{ij} - v_{ij}^+)^2 \right)_{i = 1, 2, \ldots, n} \quad (7)$$

Step 5. Calculate the relative closeness of each alternative to the ideal solution. The relative closeness of the alternative $A_i$ with respect to $A^+$ is defined as:

$$RC_i = \frac{D^*_i}{D^*_i + D_i^-} \quad i = 1, 2, \ldots, n \quad (8)$$

Step 6. Rank the alternatives according to the relative closeness to the ideal solution. The smaller the value $RC_i$, the less distance the alternative $A_i$ to the ideal solution. The best alternative is the one with the greatest relative closeness to the ideal solution.

### 3. Data Analysis

Performing data analysis can include various criteria. We have chosen these eight criteria, including, detection and missed samples, fast positive alarm, scanning speed, file copying, archiving and unarchiving, encoding and transcoding, installing and uninstalling applications, launching application. These eight are the most important ones (On-Demand Comparative; 2011, Performance Test, 2011).

#### 3.1. Detection and Missed Samples

The following diagram shows anti-viruses situation in detection and cleaning of computer viruses. The used percentages in this diagram indicate number of undetected viruses among total employed destructive codes in this comprehensive evaluation. Thus, the lower level for each anti-virus shows the stronger performance of it (On-Demand Comparative, 2011).

#### 3.2. False Positive/Alarm

In order to better evaluate the quality of the detection capabilities of anti-virus products (distinguish good files from malicious files), we provide also a false alarm test. False alarms can sometimes cause as much trouble as a real infection. Please consider the false alarm rate when looking at the detection rates, as a product, which is prone to cause false alarms, achieves higher scores easier (all discovered false alarms were reported/send to the respective Anti-Virus vendors and have been fixed).

Number of false alarms found in our set of clean files (lower is better). The graph above shows the number of false alarms found in our set of clean files by the tested anti-virus products. The graph below shows the number of false alarms found in our set of clean files by the tested Anti-Virus products (On-Demand Comparative, 2011).

#### 3.3. Scanning Speed

Anti-Viruses products have different scanning speeds due to various reasons. It has to be taken in account of how reliable the detection rate of an Anti-Virus is; if the Anti-Virus product uses code emulation, if it is able to detect difficult polymorphic viruses, if is does a deep heuristic scan analysis and active rootkit scan, how deep and thorough the unpacking and unarchiving support is, additional security scan, if it really scans all file types (or uses e.g. white lists in the cloud), etc. Most products have technologies to decrease scan times on subsequent scans by skipping previously scanned files. As we want to know the scan speed (when files are really scanned for malware) and not the skipping files sped, those technologies are not taken into account here, In our opinion some products should inform the users more clearly about the performance-optimized scans and then let the users decide if they prefer a short performance-optimized scan (which does not recheck all files, with the potential risk of overlooking infected files!) or a full-security scan.
The following graph shows the throughput rate in MB/Sec (higher is faster) of the various Anti-Virus products when scanning (on-demand) with highest setting our whole set of clean files (used for the false alarm testing). The scanning throughput rate will vary based on the set of clean files, the setting and the hardware used (On-Demand Comparative, 2011).

3.4. File Copying

Some Anti-Virus Products do not scan all kind of files by design/default (e.g. based on their file extensions), or use fingerprinting technologies, which may skip already scanned files in order to increase the speed. We copied a set of different file types which are widespread at home and office workstations from one physical hard disk to another physical hard disk (Performance Test, 2011).

3.5 Archiving and Unarchiving

Archives are commonly used for file storage, and the impact of Anti-Virus software on the time taken to create new archives or to unarchive files from existing archives may be to interest for most users. We archived a set of different file types which are widespread at home and office workstations from one physical hard disk to another physical hard disk and unzipped them after this again on a third physical hard disk. The results already consider the fingerprinting/optimization technologies of the Anti-Virus product, as most users usually make archives of files they have on their disk (Performance Test, 2011).

3.6. Encoding and Transcoding

Music files are often stored and converted on home systems, and converting such files takes system resources. Due that, many home users may be interested to know if their Anti-Virus product imposes a slowdown while converting multimedia files from one format to another. We encoded and transcoded some multimedia files with FFmpeg, and for the iPod conversion we used HandBrakeCLI. The impact during FFmpeg and iPod converting was almost the same (Performance Test, 2011).
3.7. Installing and Uninstalling Application
We installed several programs (Like Visual C++, .Net Framework, etc.) with MSI installers, and then uninstalled them and measured how long it took. We did not consider fingerprinting, because usually an application is only installed once (Performance Test, 2011).

Table 5. Anti-viruses speed in terms of affecting installation and deletion of software

<table>
<thead>
<tr>
<th>Anti-Virus</th>
<th>Score</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avast</td>
<td>Very Fast</td>
<td>9</td>
</tr>
<tr>
<td>AVG</td>
<td>Very Fast</td>
<td>9</td>
</tr>
<tr>
<td>AVIRA</td>
<td>Very Fast</td>
<td>9</td>
</tr>
<tr>
<td>Bitdefender</td>
<td>Fast</td>
<td>7</td>
</tr>
<tr>
<td>eScan</td>
<td>Fast</td>
<td>7</td>
</tr>
<tr>
<td>ESET</td>
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<td>9</td>
</tr>
<tr>
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</tr>
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<td>McAfee</td>
<td>Very Fast</td>
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<tr>
<td>Microsoft</td>
<td>Very Fast</td>
<td>9</td>
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<tr>
<td>Panda</td>
<td>Very Fast</td>
<td>9</td>
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<tr>
<td>PC Tools</td>
<td>Very Fast</td>
<td>9</td>
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<tr>
<td>Qihoo</td>
<td>Fast</td>
<td>7</td>
</tr>
<tr>
<td>Sophos</td>
<td>Very Fast</td>
<td>9</td>
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<tr>
<td>Symantec</td>
<td>Very Fast</td>
<td>9</td>
</tr>
<tr>
<td>Trend Micro</td>
<td>Fast</td>
<td>7</td>
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<tr>
<td>Trustport</td>
<td>Fast</td>
<td>7</td>
</tr>
<tr>
<td>Webroot</td>
<td>Very Fast</td>
<td>9</td>
</tr>
</tbody>
</table>

3.8. Launching Application
Office document files are very common. We opened some large document files in Microsoft office and close it. Before each opening, the workstation was rebooted. The time taken for the viewer or edit application to open and a document to be displayed was measured. Although we list the result for the first opening and the subsequent openings, we consider the subsequent opening more important, as normally this operation is done several times by users, and optimization features of the Anti-Virus products take place, minimizing their impact on the system (Performance Test, 2010).

Table 6. Launching Application speed some multimedia files with FFmpeg and HandBrakeCLI

<table>
<thead>
<tr>
<th>Anti-Virus</th>
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<th>Value</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>Webroot</td>
<td>Very Fast</td>
<td>9</td>
</tr>
</tbody>
</table>

4. Research Findings
Results of test have been collected based on detection and missed samples, false positive/Alarm, scanning speed, file copying, archiving and unarchiving, encoding and transcoding, install/uninstall application and launching application.
This decision making problem has 20 options and 8 criteria and the result of options assessment for detection and missed samples, false positive/Alarm, scanning speed, file copying, archiving and unarchiving, encoding and transcoding, install/uninstall application and launching application as well as result of scale-less matrix with respect to formula $X_{ij}$ are as follows and The scale for decision-making matrix norm method is used:

$$n_{ij} = \frac{X_{ij}}{\sqrt{\sum_{k=1}^{n} X_{kj}^2}}$$

Significance coefficients of these criteria by means of eigenvector are respectively as followings:

$$W = [0.215, 0.215, 0.215, 0.071, 0.071, 0.071, 0.071, 0.071]$$

Calculate the weighted normalized decision matrix :

$$v_{ij} = w_i n_{ij} \quad i = 1, 2, \ldots, 20 \quad j = 1, 2, \ldots, 8$$

Determine the positive ideal solution $A^+$ and negative ideal solution $A^-$ as below:

For value C1 positive ideal $A^+ = \{0.0027\}$ and negative ideal $A^- = \{0.1309\}$

For value C2 positive ideal $A^+ = \{0.0000\}$ and negative ideal $A^- = \{0.1033\}$

For value C3 positive ideal $A^+ = \{0.0729\}$ and negative ideal $A^- = \{0.0311\}$

For value C4 positive ideal $A^+ = \{0.0166\}$ and negative ideal $A^- = \{0.0092\}$

For value C5 positive ideal $A^+ = \{0.0172\}$ and negative ideal $A^- = \{0.0057\}$

For value C6 positive ideal $A^+ = \{0.0176\}$ and negative ideal $A^- = \{0.0097\}$

For value C7 positive ideal $A^+ = \{0.0165\}$ and negative ideal $A^- = \{0.0128\}$

For value C8 positive ideal $A^+ = \{0.0161\}$ and negative ideal $A^- = \{0.0125\}$

The separation of each alternative from the positive ideal solution ($A^+$) and the negative ideal solution ($A^-$) are given as below:

$$D_i^+ = \left(\sum_{j=1}^{n} (v_{ij} - v_{ij}^+)^2\right)^{1/2}$$

$$D_i^- = \left(\sum_{j=1}^{n} (v_{ij} - v_{ij}^-)^2\right)^{1/2}$$

### Table 7. Results of tests based on the studied criteria

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>C5</th>
<th>C6</th>
<th>C7</th>
<th>C8</th>
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<tbody>
<tr>
<td>A1</td>
<td>2.7</td>
<td>10</td>
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</tr>
<tr>
<td>A2</td>
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</tr>
<tr>
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For value C5 positive ideal $A^+ = \{0.0172\}$ and negative ideal $A^- = \{0.0057\}$

For value C6 positive ideal $A^+ = \{0.0176\}$ and negative ideal $A^- = \{0.0097\}$

For value C7 positive ideal $A^+ = \{0.0165\}$ and negative ideal $A^- = \{0.0128\}$

For value C8 positive ideal $A^+ = \{0.0161\}$ and negative ideal $A^- = \{0.0125\}$

### Table 8. Results of $D_i^+$ and $D_i^-$

<table>
<thead>
<tr>
<th>$D_i^+$</th>
<th>Score</th>
<th>$D_i^-$</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D_{c1}$</td>
<td>0.0298</td>
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<td>0.1439</td>
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<tr>
<td>$D_{c2}$</td>
<td>0.1093</td>
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<td>0.0954</td>
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<td>$D_{c4}$</td>
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<td>0.1479</td>
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<td>$D_{c6}$</td>
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<td>$D_{c8}$</td>
<td>0.0387</td>
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Calculate the relative closeness of each alternative to the ideal solution. The relative closeness of the alternative $A_i$ with respect to $A^+$ is defined as:

$$RC_i = \frac{D_i^+}{D_{ci}^+ + D_{ci}^-}$$
Table 8. Results of $RC_i$

<table>
<thead>
<tr>
<th>$RC_i$</th>
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</tr>
</thead>
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<td>$RC_{19}$</td>
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</table>

5. Conclusion

The smaller the value of $RC_i$, the nearer it is close to the ideal solution. Therefore, A3 is the best alternative, and A14 is the worst alternative. In this assessment, option A14 i.e. PC Tools Spyware Doctor with Antivirus 2012 is the worst antivirus and As a result, Option A3 i.e. AVIRA Free Antivirus 2012 will be the best option. This Model according to the mentioned conditions is able to do the ranking repeatedly by updating number of antivirus and their criteria.

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References