



DecisionPad 3

Helps organizations get decisions *made*

Tutorial Guide

DecisionPad3 Tutorial Guide

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Contact:

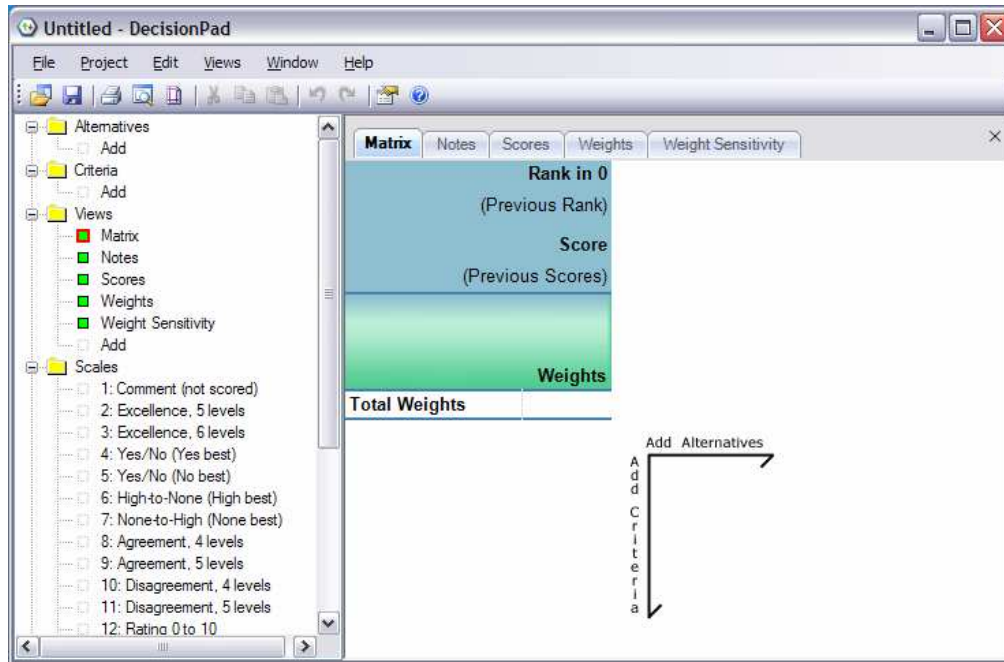
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The Basics

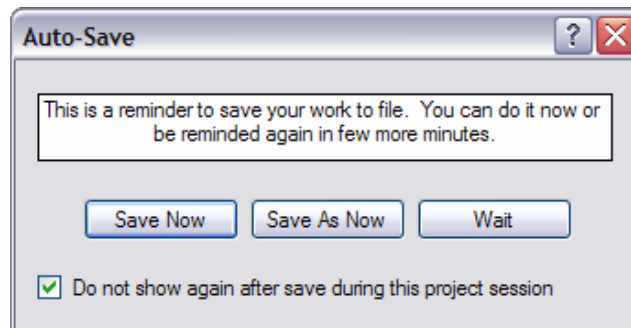
Start DecisionPad. If you haven't yet purchased your license, select "Continue as Demo." Select a "New Blank Decision" project. The screen will look like this:



Alternatives will go across the top. Alternatives are the choices that will be ranked. Criteria will be listed in rows. Criteria help rate the alternatives. Weights (listed to the right of each criterion) set how important each criterion is.

Behind the Matrix view are various analysis report tabs, all empty at this point.

Note: after about 15 minutes of making changes to this file you will get the Auto-Save dialog:



Since we cannot predict when this will happen we bring it up here. You can elect to save the file or wait for purposes of this tutorial.

There is a tree-view of the elements of your decision matrix to the left. Alternatives is the first category. Double-click in the tree the *Add* under Alternatives to get the setup dialog:

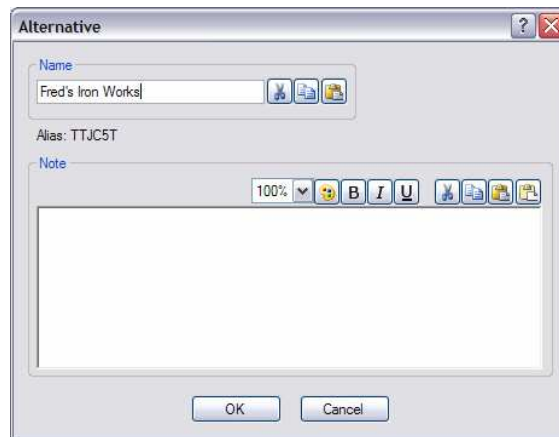


The name is the only thing that is required to set up an alternative.

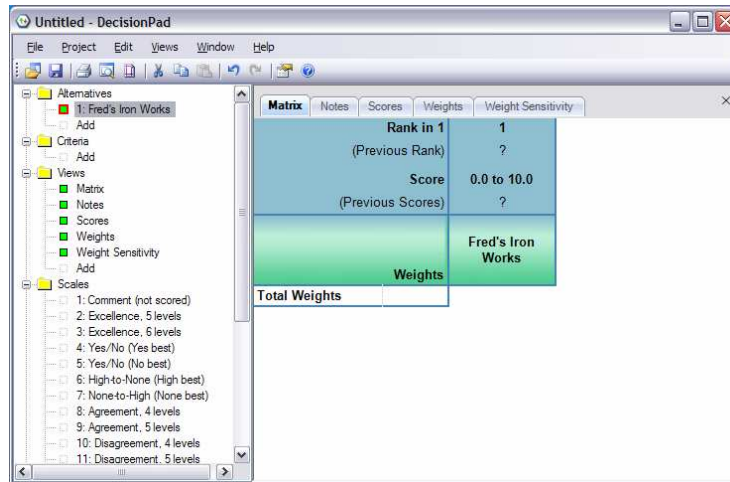
The Alias is helpful when you wish to publish anonymous reports. The Alias is a randomly assigned value, guaranteed to be unique, that can stand in for the descriptive name. For example, you can create a report to show to the vendors (alternatives), so they can see how they ranked in the decision-making process without revealing who their competition was.

Notes are optional comments on each alternative that can be displayed in various reports. The bold, italic, etc settings apply to the notes, not the name.

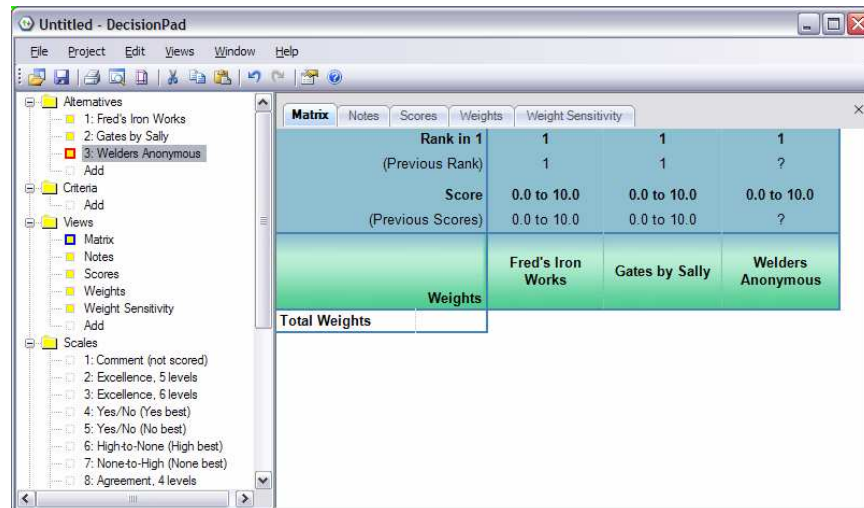
Let's imagine we are ranking vendors on their performance this year. Enter "Fred's Iron Works" as the first alternative name:



Click OK and your matrix will look like this:

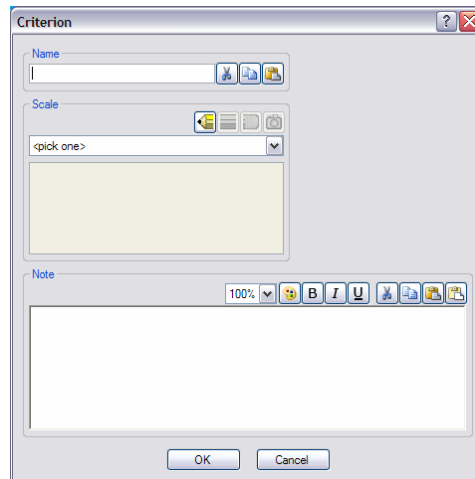


Following the same process listed above, enter a couple more alternatives, "Gates by Sally" and "Welders Anonymous":



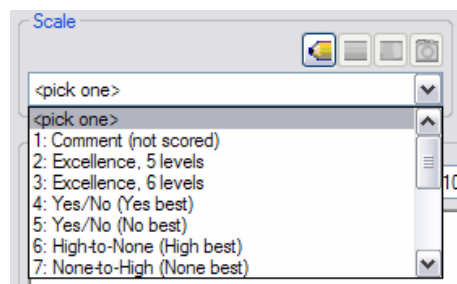
Observe that all three alternatives have the same ranking because there are no criteria yet to distinguish them. The scores for each one range from 0.0 to 10.0, as the lack of information means every score from lowest to highest is possible for each alternative. The previous scores and ranking show a ? for the last alternative we added.

Now let's add some criteria with which to evaluate the Alternatives. On the tree to the left, under Criteria, Double-click *Add*:

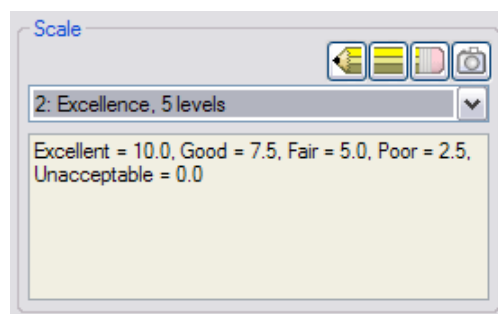


Let's start with "Dependability" as the first criterion. Type "Dependability" in the 'Name' input field.

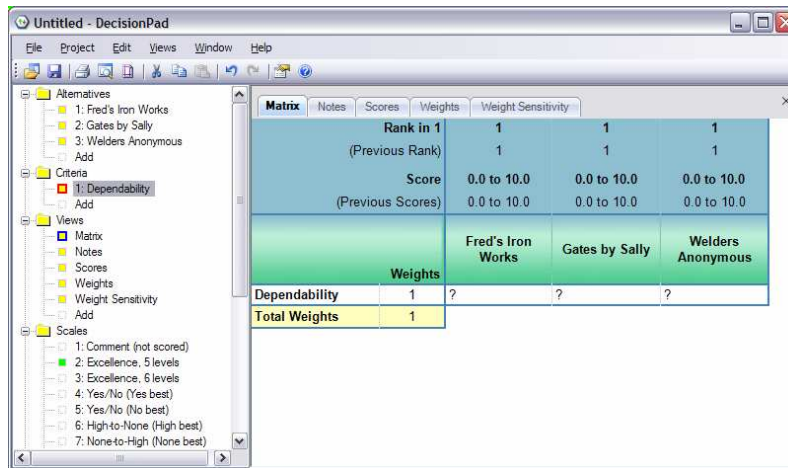
Criteria require a scale selection. Scales convert the evaluation words into a score from 0 to 10. This allows DecisionPad to make calculations and rankings based on more subjective evaluations such as "excellent" or "medium." If you pull down the scale list you see the built-in ones:



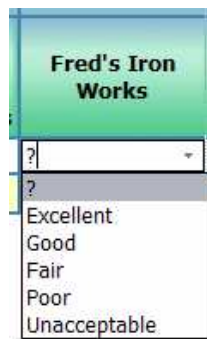
We could use either Excellence or High-to-Low, or create our own with the pencil point to insert. Select *2: Excellence-5 levels*. The dialog will show the word values for this scale and its scoring between 0 and 10:



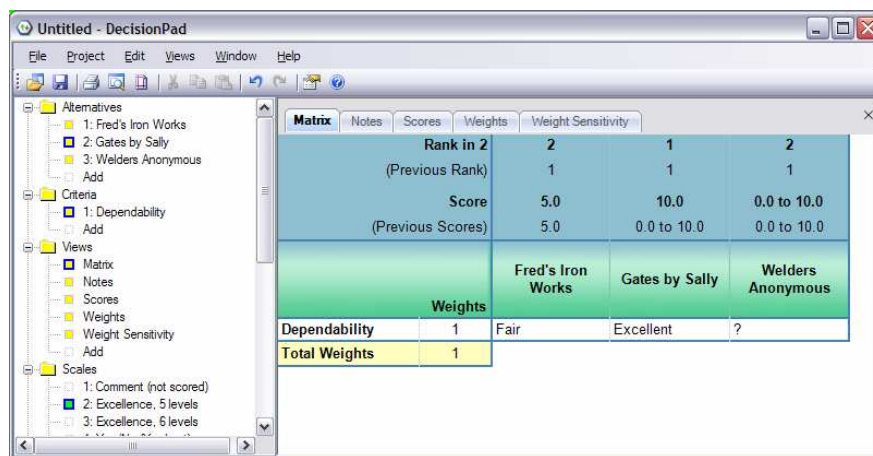
See the Scales and Scoring tutorial for more on how these work. Click OK to return to the Matrix view.



The criterion appears with question marks for each alternative. Each grid cell has a pull-down list with the options available for that cell. Pull down the list for Fred's by clicking on the arrow at the right end of the selected grid cell.



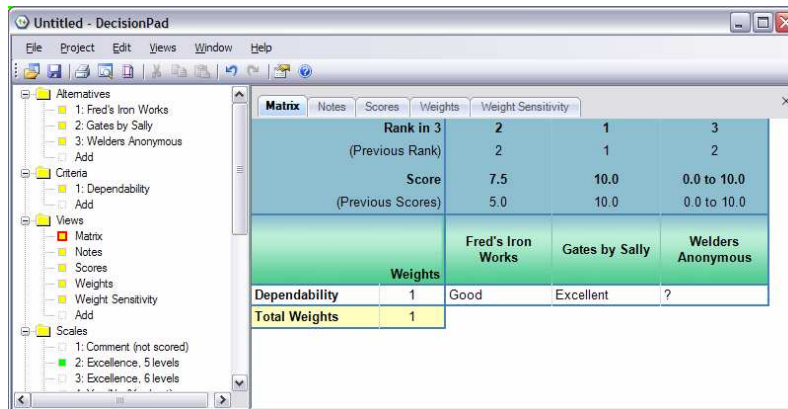
Select Fair for Fred's and Excellent for Sally:



In the score row for Fred's you see 5.0, which is the scale's score value for Fair and for Sally 10.0, the scale's score value for Excellent. Because Welders remains a ? it still shows a possible score range of 0.0-10.0.

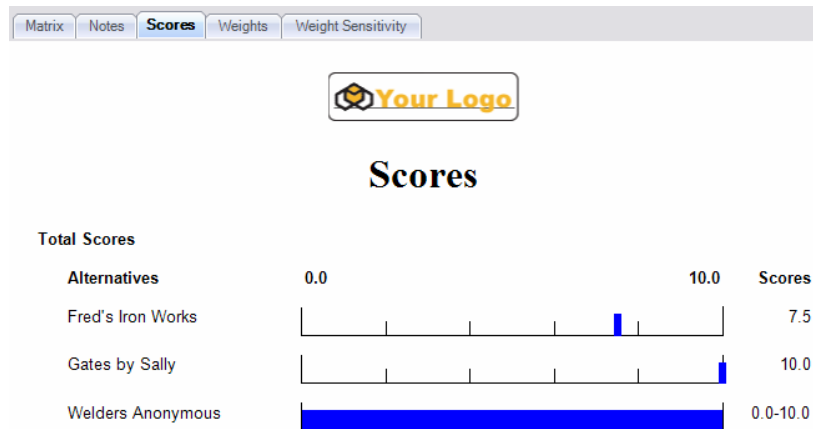
So how did it come up with a ranking, with one of the alternatives showing a range of possible scores, since the cells aren't all filled in? It uses the mid-point of the score ranges or 5.0 for

Welders, which is why it is ranked #2 along with Fred's. Change the value on Fred's to Good and you get



When you have more criteria and the data fills in the unknowns these ranges will narrow gradually. At some point one alternative will dominate. It will have a score that beats everyone else's no matter what the remaining question marks might turn into. At that point you are done for practical purposes.

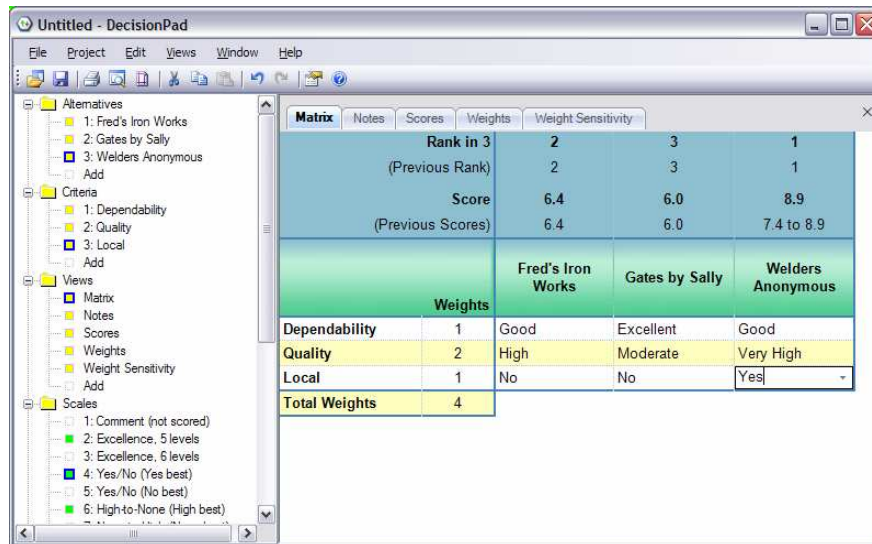
Another way to see this is to select the Scores report by clicking on the Scores tab at the top. This report shows the rankings graphically:



In this simple one-criterion case, you can see that Welders has the possibility of tying Sally depending on the Welders Dependability rating. Welders could be better or worse than Fred's since its score uncertainty bar overlaps Fred's. This ordering might be relevant if this were a ranking, say for merit pay, instead of picking one.

[As an aside, the logo is shared by all reports in the project and is selected in the File, Properties dialog. The View, Properties dialog controls the title, footer and whether to show the logo. The view starts out with placeholders you can change at your convenience.]

Return to the Matrix view by clicking on the Matrix tab at the top. Add two more criteria the same way we did before, by double-clicking on Add under Criteria in the tree on the left. Add "Quality" with the High-to-None (High Best) scale; and "Local" with the Yes-best scale. Then punch in some data using the drop-down menu on the right edge of each cell. If you want your reports to match the ones in the tutorial, match the values used in the next screen shot (then the explanations below will also match).



Now change the weight of Quality to “2” by highlighting the 1 under Weights in the matrix and changing it to 2 to match the picture above. The new weight will be accepted after you leave the cell by clicking another active cell, or hitting the Enter or Tab key. Weights control how much importance each criteria is given, so by making this change you make Quality twice as important as Dependability and twice as important as Local.

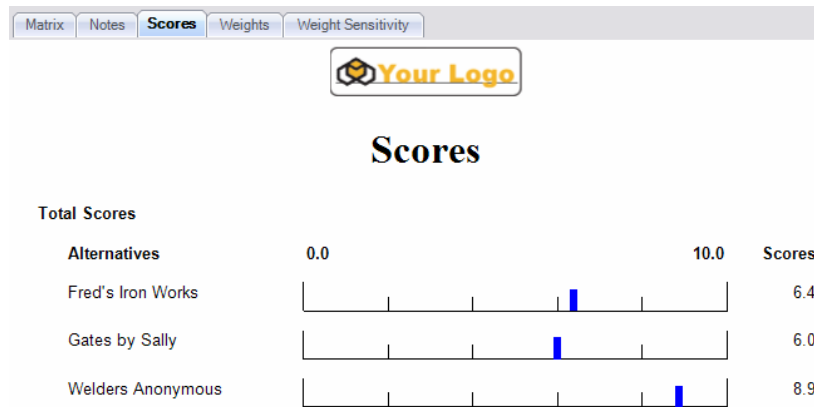
The tree view on the left gives you some clues that may be helpful. Alternatives, Criteria and Views have yellow boxes. Sharable Scales or Text Styles that are in use have green boxes. Scales or Text Styles that are not yet in use, but which are available for you, are empty dotted squares.

Tree items get a blue or red border when they are selected. When something is selected in the tree itself that item will have a red bordered square and will be the only one. When you select something in the Matrix the items in the tree matching that Matrix cell get blue bordered boxes, like the screen shot above where the lower-right cell was selected so its alternative, criterion, scale and view marker boxes all have blue borders in the tree.

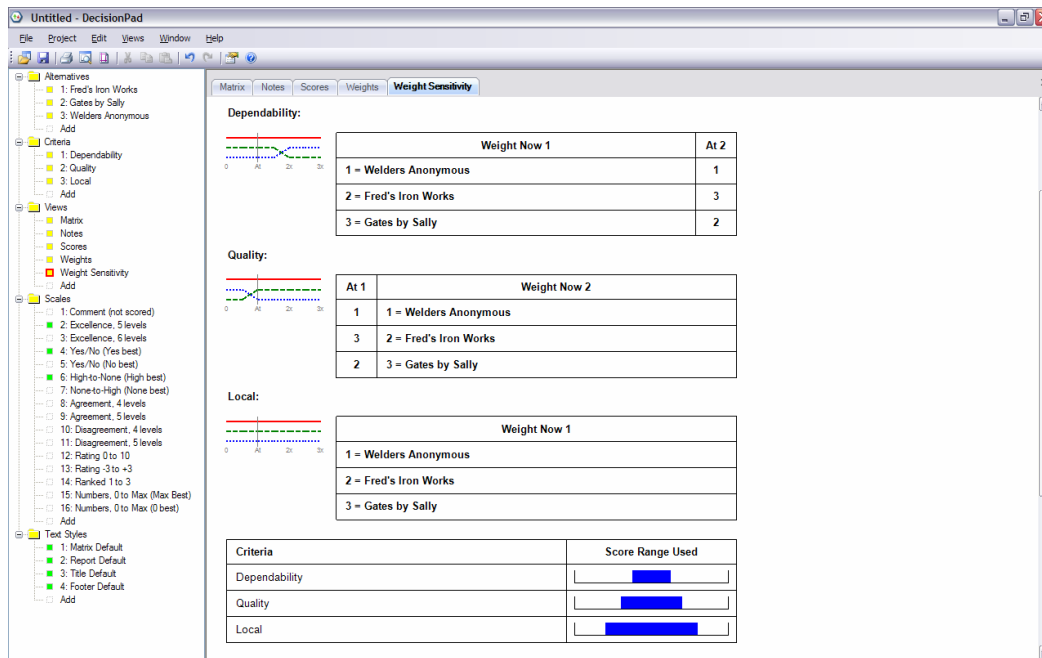
When you select a different view tab it will initially show a red bordered yellow square for that view in the tree. If it is a report tab you can make other selections in the tree and edit them, such as picking an alternative and changing its name which will be reflected in the report. You cannot select and edit items in the report view itself.

When you have a larger decision you can use the tree to bring an off-screen Matrix item into view – just click on what you want to see in the tree, and DecisionPad will scroll it into view.

If you used our same values, your Scores report will now show all single-value scores, with Welders as the best:



Take a look at the Weight Sensitivity view:



This one takes a moment to explain! It is giving you a feel for how the rankings react to changes in the weights, a useful way to see which issues are truly important. There is no point in arguing about a weight that does not make much difference.

The colored line graph is a “spark” which shows how the rankings shift around when varied from 0 to triple the weight in half-steps. The vertical line is at the current worksheet setting and the lines cross where the change in the criterion’s weight causes a ranking shift. “Sparks” are tiny graphs which can make it easier to understand data than pure numbers. See *Beautiful Evidence* by Edward Tufte for more on this powerful concept.

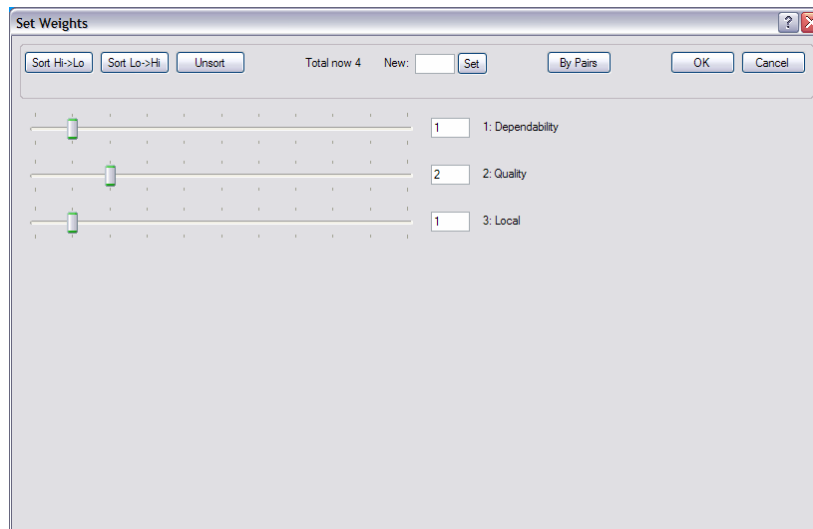
The Rank shifts in the table show how the rankings change as the weights are varied from 0 the triple but with more resolution than half-steps. It is somewhat the same info as the sparks -- more complete though not as easy to scan.

Let's see what's happening in our example. The first table shows how Dependability's weight is affecting the outcome. "Weight Now 1" means its current weight is set at 1. Our current ranking is Welders, Fred's, Sally – an order you can see in the "Now" section of each of the three tables, as our current rankings are repeated each time for easy reference. The part that changes is the narrow column to the left or right. For Dependability, another column appears to the right, displaying the rankings if the weight were set to 2 for this criteria. If we were to change the weight, the 2nd and 3rd place choices would switch places. However, no matter what happens with the weight of Dependability, we can see that it will not affect Welder's status as our first choice.

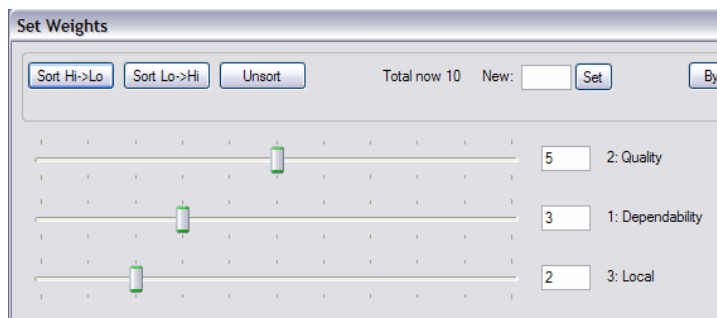
As a practical matter, then, any discussion of whether Dependability is as important as Quality or less important than Local can be skipped. Changing Dependability's weight will not affect the outcome over the zero to three times range. Actually, you can see in the sparks graphs, with those three straight red lines, that the weights do not affect the first place winner for any of the Criteria in this simple example. The entire discussion of weights is complete at this point.

The Score range shows how much the values differ in their scores. This is a way to make sure your scales reflect how valuable differences in the answers are. In other words when there really is little difference in the alternatives for a particular criterion there should be a small score range. Big perceived differences in utility should have a big score range. This is particularly important to check when using number or date scales to make sure the scale selection is not blowing a tiny cost difference up out of proportion or understating the value of a delivery date difference. See the Scales and Scoring tutorial below for more on this.

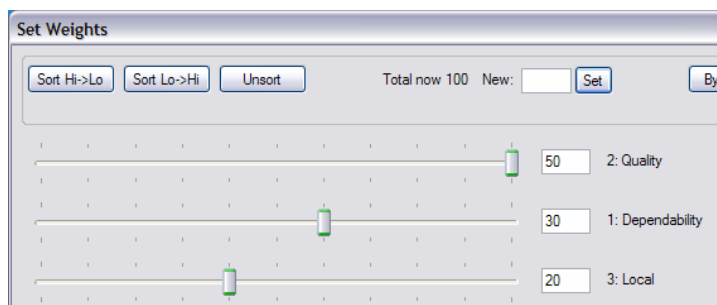
It is often useful to set weights or subjective values in a more graphic fashion. Switch back to the Matrix view and select *Weights Slider Set* in either the Edit pulldown menu or the grid right-click popup menu:



You can adjust the sliders and click the sort buttons to examine whether the profile reflects how important these items are:



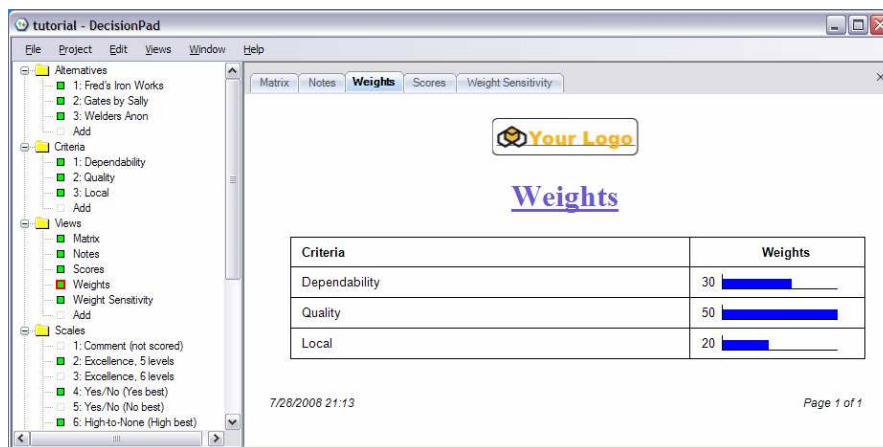
The weights are always relative. The actual numbers do not affect the decision, so if they're all 5 it's exactly the same as if they're all 50. However typing 100 into the *New* box at the top (to set a new Total) and clicking the *Set* button makes the weights look like percentages, often easier for people to relate to:



Note that it's okay if the sliders jump to a new location when you change the total. DecisionPad is also adjusting the range of the slider, so if it was 0-40 it might change to 0-50 when the numbers change. This will change its position, but their *relative* values will remain the same. After clicking Ok the Matrix will show the new weights and their impact on the decision, if any.

To view their impact on the decision, you can look at the Matrix tab: "Previous Rank" and "Previous Score" will show you the impact of your change on the results. You can also check in with the Weights Sensitivity tab again, to see if your new weights open up any possible different outcomes.

You can also present the weights as a graph in the *Weights* report which looks like:

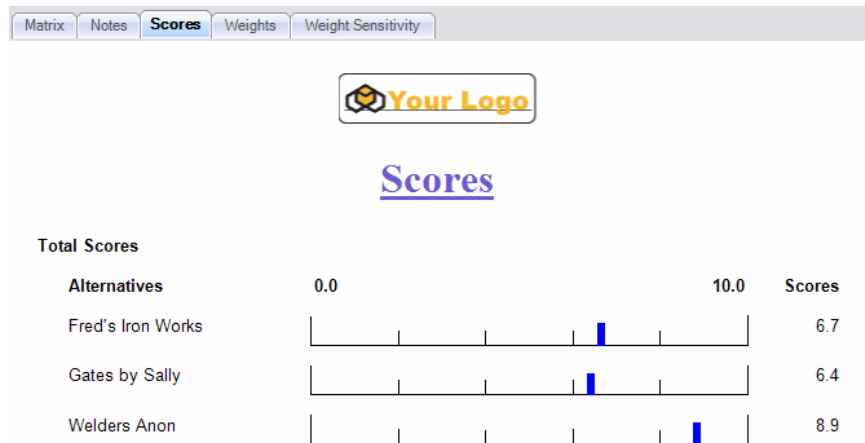



You will find what we've done so far saved for your convenience as *Tutorial-1.dp3* in your *Samples* folder.

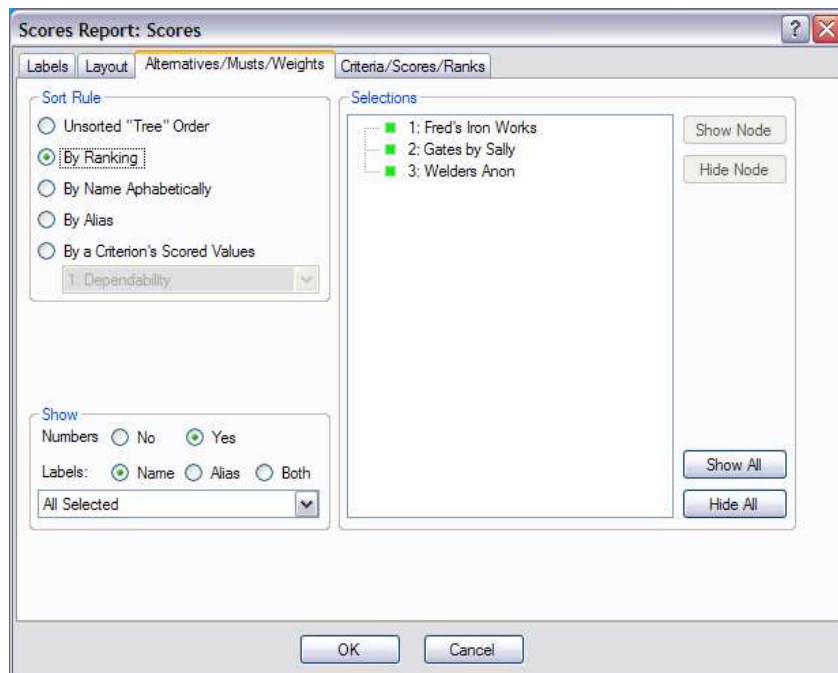
Show-Hide-Sort for Reports and Matrix

Open the *Tutorial-1.dp3* in your *Samples* folder. If you used the default installation, they will be under Program Files/Apian Software/DecisionPad 30/Samples. This file contains the work done in the preceding tutorial section.

If you switch to the Scores report tab you see this:

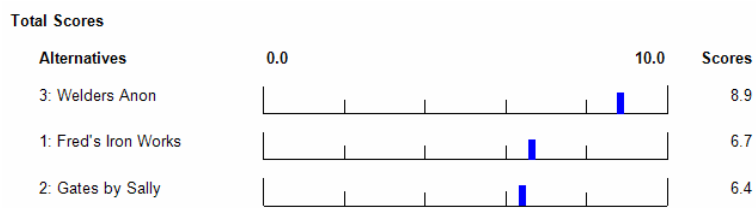



This is the default report because it provides a nice summary. By default the alternatives are in the as-created "tree" order, but you might want to show results sorted by ranking. From the File Menu, select *Views, View Properties*, or click its toolbar , and select the *Alternatives* tab:

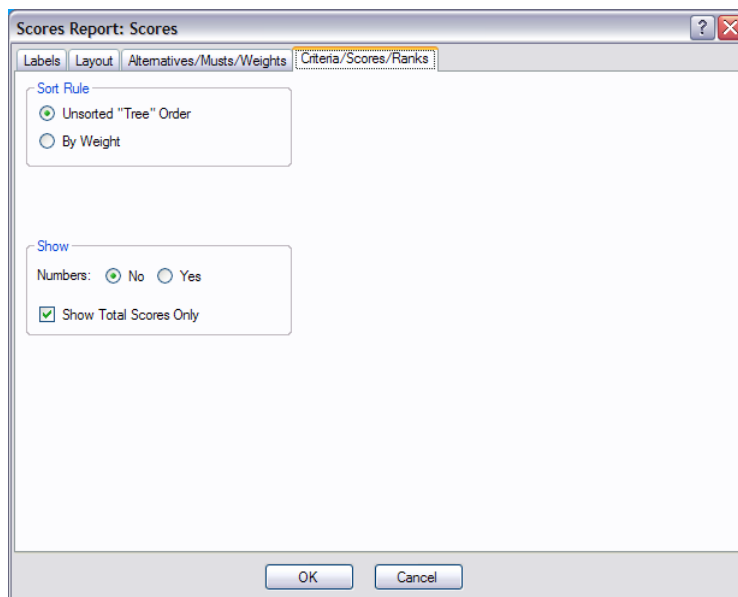


Change the *Sort Rule* to *By Ranking* and the alternative label *Numbers* to *Yes*.

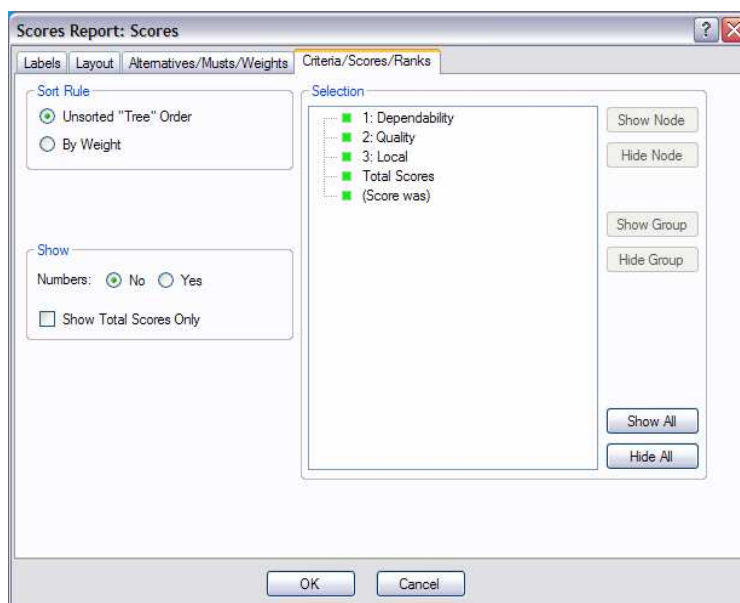
After OK the report becomes:



You might also want to show all of the criteria in a Scores report. This will give a graphical view of how each Alternative was ranked for each criterion. Select *View Properties* again from the View menu or click its toolbar button  and the *Criterion* tab this time:



It comes up with *Show Total Scores Only* checked which gives you the summary result you've been viewing. Uncheck it and the criterion selection tree appears:

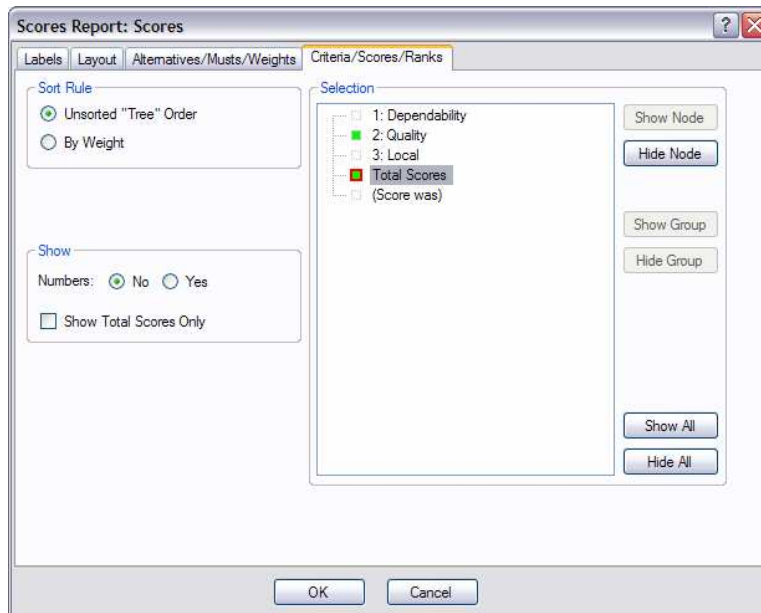


Click OK and you can see the graphical view of the score for each criteria, as well as the overall total (scroll up and down to see it all):



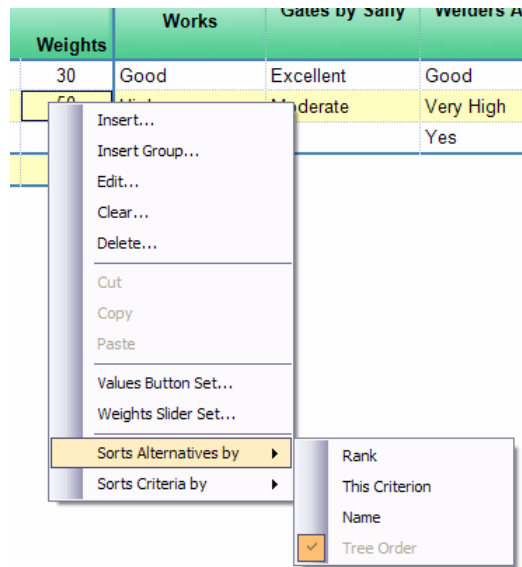
Note that the order for the alternatives is based on the Total Scores for the whole report; thus the order is consistent across all the criteria – Welders appears in the first line of each graph because it is in first place, and Total Scores is currently sorted by Ranking.

You can control which criteria appear in this report. To show just one criterion and the Totals, go back to the View Properties, *Criteria* tab:



We'll change it to showing just Quality and Total Scores. One way is to click *Hide All*, then click the *Quality* item and click *Show Node*, and again click *Scores* and *Show Node*. When you click OK only those two items will be in the report.

Go back to the Matrix screen. Let's say you wanted it to be sorted by ranking too. You could do that by *Right-Clicking* anywhere in the matrix to get the popup menu. In the popup menu, hover over Sorts Alternatives by to show the submenu to the right:



The alternatives are currently sorted in *Tree Order*, the order in the tree at the left, which could also be called “un-sorted”. Change it to one of the other sort rules, *Rank*.

Remember these sort rules apply to the current status of the rankings, not just at the time you request the sort. When you modify the weights or values enough to change the ranking, the matrix and reports would automatically re-sort according to your rules. Give it a try.

The hide and sort rules are set for each view so you can have multiple separate scores reports showing different aspects of the decision. Every report and additional matrix view (beyond the first one) can have its own hide and sort rules. The built-in matrix view does not let you hide alternatives or criteria, but if you need a matrix view showing only part of the criteria or only some of the alternatives you can create an additional matrix. More information on this is available in the reference section.

Impact Arrows and Must Haves


For this tutorial, we need a worksheet with more criteria preloaded. Open the *Tutorial-2.dp3* in your *Samples* folder and select the Matrix view tab. This shows a tradeoff between three printing options:

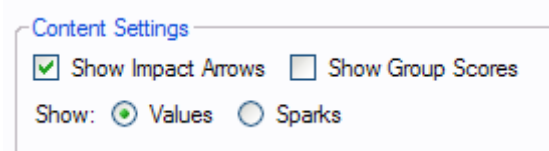
Matrix				
Notes	Scores	Weights	Weight Sensitivity	
Rank in 3		2	1	3
(Previous Rank)		?	?	?
Score		5.7	6.2	5.6
(Previous Scores)		?	?	?
		♪Central Laser	♪Four Lasers	♪15 Individual Inkjets
Weights				
Retail Price	21	\$6,999	\$3,596	\$5,985
Financing Plans	11	Yes	Yes	No
Print Speed	19	35 ppm	25 ppm	20 ppm
Duplex Printing	9	Yes	Yes	Yes
Cost per Page - Color	18	57 ¢	84 ¢	38 ¢
Yearly Maintenance Fees	11	Good	Fair	Poor
Ease of Use	11	Hard	Average	Easy
Total Weights	100			

There are ♪ markers before the alternative names which indicate notes have been attached. Hover the mouse over one and the note pops up. Right-click on one of them, select the Edit option, and you can see how they were entered. Notes can be attached to criterion names or value cells as well. Some general notes are defined in the Project, Overall Notes. Take a quick look at the Notes Report tab to see how they can be used to document the decision context.

Return to the Matrix view.

You may also want to look at the definitions for the \$, ¢, CCP and PPM scales to see how the symbols were handled. Double-click on the Criteria and click on the middle portion of the pencil to open the Scale definition dialog. Then switch to the Numbers tab to view Symbol selection at the bottom. Characters not on your keyboard like the ¢ can be set with the Windows System Tool called *Character Map*.

Now let's look at "impact arrows" for the Matrix. Select the menu *Views, View Properties* or click its toolbar button . Go to the Layout tab and check the Show Impact Arrows box, then click OK:



A new column has appeared next to each value setting, displaying impact arrows. Two of these arrows are bolder than the others to show the cells with the biggest impact. To make these calculations, DecisionPad sorts all the cells by their impact on the decision, and selects the 10% with the greatest impact for large arrows. The smaller arrows show the next level of impacts, displaying the next 25% of the cells. Altogether 35% of the cells of any matrix will receive impact arrows, allowing you to focus on the more important third of the issues, or the most important 10%.

Matrix		Notes	Scores	Weights	Weight Sensitivity
Rank in 3		2	1	3	
(Previous Rank)		?	?	?	
Score		5.7	6.2	5.6	
(Previous Scores)		?	?	?	
Weights		Central Laser	Four Lasers	15 Individual Inkjets	
Retail Price	21	\$6,999	↓ \$3,596	↑ \$5,985	
Financing Plans	11	Yes	Yes	No	↓
Print Speed	19	35 ppm	↑ 25 ppm	20 ppm	↓
Duplex Printing	9	Yes	Yes	Yes	
Cost per Page - Color	18	57 ¢	84 ¢	↓ 38 ¢	↑
Yearly Maintenance Fees	11	Good	Fair	Poor	
Ease of Use	11	Hard	Average	Easy	
Total Weights	100				

The two biggest effects are the retail price and cost-per-page of the 4 mid-sized laser printer solution, with price helping and page cost hurting. The smaller arrows show the other strong influences like Print Speed for the other two solutions.

“Impact” is determined by the combination of

- the weight for the criterion, its importance, and
- the difference in a cell value’s score from the average score within each criterion

Thus a heavily weighted criterion will tend to have more impact but only if the values within that criterion also have significant differences between alternatives. If all the values are the same like Duplex Printing above it does not matter how big the weight is, the decision does not change. Try changing its weight to 0 or 100 and note that the rankings stay the same (you will have to leave the weight cell with the mouse or enter key before the totals are updated).

Return the Duplex Printing weight to 9.

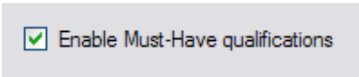
Try changing values around to see what happens. For example if you reduce the weight on Price to 10 then the ranking shifts so the Central Laser is the best, primarily due to the 4 Lasers’ Cost-per-Page, and the balance of other factors making the Central Laser better than the 15 small printers:

Matrix		Notes	Scores	Weights	Weight Sensitivity
Rank in 3		1	3	2	
(Previous Rank)		2	1	3	
Score		6.4	5.7	5.9	
(Previous Scores)		5.7	6.2	5.6	
Weights		Central Laser	Four Lasers	15 Individual Inkjets	
Retail Price	10	\$6,999	↓ \$3,596	↑ \$5,985	
Financing Plans	11	Yes	Yes	No	↓
Print Speed	19	35 ppm	↑ 25 ppm	20 ppm	↓
Duplex Printing	9	Yes	Yes	Yes	
Cost per Page - Color	18	57 ¢	84 ¢	↓ 38 ¢	↑
Yearly Maintenance Fees	11	Good	Fair	Poor	
Ease of Use	11	Hard	Average	Easy	
Total Weights	89				

The arrows provide one more way to see what matters in the decision, and thus to focus discussion and fact-finding on the areas that matter. They are especially handy as the number of alternatives and criteria grow, or for that matter, as the number of people with opinions grows.

You might want to take a look at the Weight Sensitivity report and experiment with the weights to see how these two presentations interact.

Sometimes there are minimum requirements for some criteria which you may want to document explicitly – in DecisionPad they are called “Must Haves”. Go to the *Project, Scoring* menu item, and set



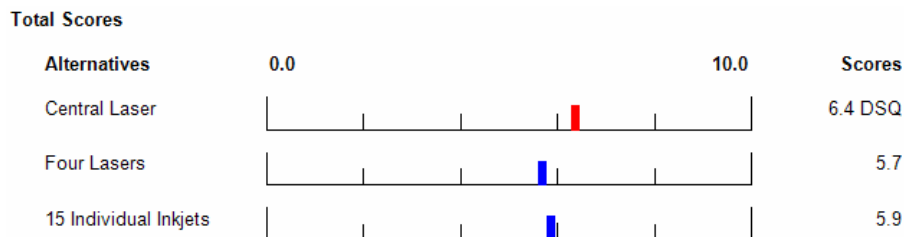
in the dialog and click Ok. The Matrix will now have a new column for Must Have. Use the drop-down list on the right side of the cell for Ease of Use in the Must Have column. Set a Must Have threshold of Average and you get:

Rank in 3 (Previous Rank)		DSQ	2	1	
Score (Previous Scores)		DSQ (6.4)	5.7	5.9	
Weights		Must Have	↕Central Laser	↕Four Lasers	↕15 Individual Inkjets
Retail Price	10	?	\$6,999	\$3,596	\$5,985
Financing Plans	11	?	Yes	Yes	No
Print Speed	19	?	35 ppm	25 ppm	20 ppm
Duplex Printing	9	?	Yes	Yes	Yes
Cost per Page - Color	18	?	57 ¢	84 ¢	38 ¢
Yearly Maintenance Fees	11	?	Good	Fair	Poor
Ease of Use	11	Average	Hard	✗ Average	Easy
Total Weights	89				

The Central Laser does not meet this requirement so it is marked disqualified (DSQ) in the scores and ranks, with a red X for the cell (or cells) which caused the DSQ. This drops the Central Laser out of the ranking and the 15 Individual Inkjets become the choice.

The score still shows because there are times like this when the score is high enough for other reasons to make it worth investigating workarounds or negotiating other ways to meet the requirement. The central printer scores 6.4 versus the 15 Individual Inkjets at 5.9 so the ease of use cutoff is worth discussion.

If you go to the Scores report you can see this graphically:



The Central Laser alternative is plotted in red instead of blue and with DSQ at the right side, but plotted ahead of the other two by scoring.

Note: It is very important to distinguish between scoring rules, set by the scale to represent the usefulness of an entry, from a hard Must Have requirement. These are different tools.

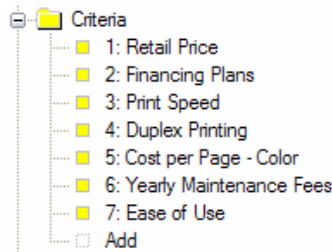
Criteria Groups

As the number of criteria grow it is useful to group them in one or more outline-like levels. It helps organize the criteria into logical blocks to aid in understanding the decision. It also allows setting the weights – importance – on the major groups separately from the details inside each group.

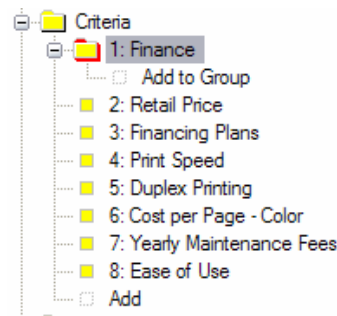
Rather than build one from scratch, open the Tutorial-2.dp3 file to start with:

Matrix				
Notes				
Scores				
Weights				
Weight Sensitivity				
Rank in 3		2	1	3
(Previous Rank)		?	?	?
Score		5.7	6.2	5.6
(Previous Scores)		?	?	?
		•Central Laser	•Four Lasers	•15 Individual Inkjets
Weights				
Retail Price	21	\$6,999	\$3,596	\$5,985
Financing Plans	11	Yes	Yes	No
Print Speed	19	35 ppm	25 ppm	20 ppm
Duplex Printing	9	Yes	Yes	Yes
Cost per Page - Color	18	57 ¢	84 ¢	38 ¢
Yearly Maintenance Fees	11	Good	Fair	Poor
Ease of Use	11	Hard	Average	Easy
Total Weights	100			

Let's include more criteria and cluster them into three groups: Financial, Features and Support. The easiest way to make this transition is to work in the tree view rather than the matrix since it shows an outline view and has outline editing menu support:



Right-click your mouse on Retail Price in the tree, select *Insert Group* from the popup menu and name the group Finance. Click OK:



Now we have the group but all the criteria remain below it at the same level. This can be useful when a single criterion is as important as the rest of the groups, worthy of standing at the top level.

Here we want to move some criteria inside our new group. There are several ways to do this. One is to drag-and-drop the Retail Price criteria onto the *Add to Group* label:

	Weights	Cent
Finance	21	
└─ Retail Price	└─ 21	\$6,999
Financing Plans	11	Yes
Print Speed	19	35 pp

The tree now shows Retail Price inside the Finance group as Criteria 1.1, and also shows it as a sub-item in the matrix view. We will come back to how it handles group weights in a moment.

Right-click Financing Plans and note there is a *Move Up* item with a *control-u* shortcut key:

- Insert...
- Insert Group...
- Edit...
- Clear...
- Delete...
- Cut
- Copy
- Paste
- Move Up Ctrl+U
- Move Down Ctrl+D

Either select *Move Up* or close the popup and use the control key with u to put Financing Plans into Finance:

	Weights
Finance	32
└─ Retail Price	└─ 21
└─ Financing Plans	└─ 11
Print Speed	19
Duplex Printing	9
Cost per Page - Color	18
Yearly Maintenance Fees	11
Ease of Use	11
Total Weights	100

Now you can see what is happening with the weights. The criteria weights are being subtotaled into the Finance group weight. The Total Weights at the bottom remains the same since we are simply moving the criteria around.

Try changing the Price weight to 11 then change the Finance group weight back to 32. You will have to leave the weight cell with the mouse or enter key before the totals are updated:

Weights	
Finance	22
└ Retail Price	11
└ Financing Plans	11
Print Speed	19
Duplex Printing	9
Cost per Page - Color	18
Yearly Maintenance Fees	11
Ease of Use	11
Total Weights	90

Weights	
Finance	32
└ Retail Price	16
└ Financing Plans	16
Print Speed	19
Duplex Printing	9
Cost per Page - Color	18
Yearly Maintenance Fees	11
Ease of Use	11
Total Weights	100

When you changed the group to 32 it retained the equal weighting and made each of them 16, half of 32. DecisionPad will retain the proportions inside a group when the group's weight is changed..

Now move Cost-per-page and Maintenance Fees into the group using any method.

Insert another group above Print Speed called "Features" and move Speed and Duplex into it.

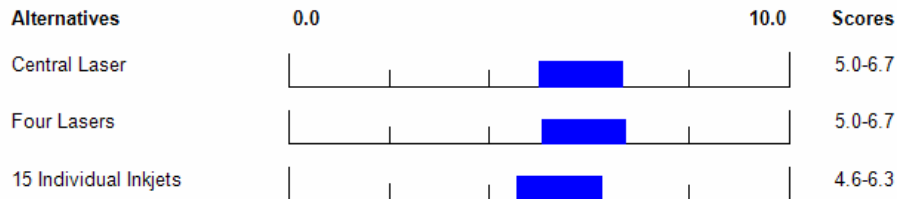
Insert another group above Ease of Use called "Support and Human Factors" and move Ease into it. Now the decision should look like this:

Weights	
Finance	61
└ Retail Price	16
└ Financing Plans	16
└ Cost per Page - Color	18
└ Yearly Maintenance Fees	11
Features	28
└ Print Speed	19
└ Duplex Printing	9
Support and Human Factors	11
└ Ease of Use	11
Total Weights	100

Insert a new criterion in the Support group by right-clicking *Add to Group*, selecting *Insert*. Give it the name “Service Quality” and the scale *Excellence 5 levels*. It’s initial weight will be 1 but set it up to 20 and then reset the total weight to 100:

		2	1	3
Rank in 3		2	1	3
(Previous Rank)		2	1	3
Score		5.0 to 6.7	5.0 to 6.7	4.6 to 6.3
(Previous Scores)		5.0 to 6.7	5.0 to 6.7	4.6 to 6.3
		Central Laser	Four Lasers	15 Individual Inkjets
Weights				
Finance	51			
— Retail Price	14	\$6,999	\$3,596	\$5,985
— Financing Plans	13	Yes	Yes	No
— Cost per Page - Color	15	57 ¢	84 ¢	38 ¢
— Yearly Maintenance Fees	9	Good	Fair	Poor
Features	23			
— Print Speed	16	35 ppm	25 ppm	20 ppm
— Duplex Printing	7	Yes	Yes	Yes
Support and Human Factors	26			
— Ease of Use	9	Hard	Average	Easy
— Service Quality	17	?	?	?
Total Weights	100			

Total Scores



Switch to the Scores Tab. The scores now overlap with this new criterion such that any of the solutions could be best depending on how their service organizations perform. The ranking was done on the mid-point (average) of each alternative’s score range.

Feel free to play around with the Matrix and reports to get more familiar with how groups operate.

Scale Definition and Scores

The underlying mathematics of DecisionPad are straightforward, although the many details and presentations handled by the program would be hard work if you tried to reproduce them all by hand, or program them into a spreadsheet. While DecisionPad does handle the details for you, a general understanding of how the scoring and weighting work may be helpful in structuring your decisions.

DecisionPad uses a weighted average evaluation – the fancy term is “multivariate weighted utility analysis” – which parallels the way our minds work well enough to be a useful intuitive framework.

You lived (and probably suffered at times) with a weighted average scoring method when you were in school. Your future was determined by a system called your Grade Point Average. The GPA was the way that accomplishment in French, History, Tennis and Algebra were put on common ground, just like DecisionPad puts everything on a common scoring system.

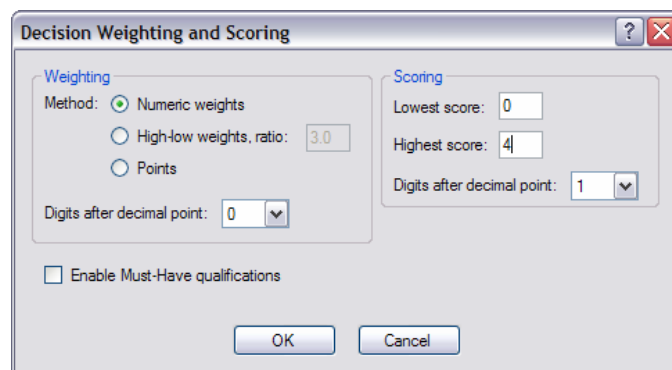
So let's turn DecisionPad into a “GPA computer”. The parallels are:

- Grade Points are 4.0 for A, 3.0 for B, etc defined as a *Keyword Scale*
- Classes taken are the *Criteria*
- Units assigned to each class set their importance, so they are *Weights*
- People getting graded are the *Alternatives*

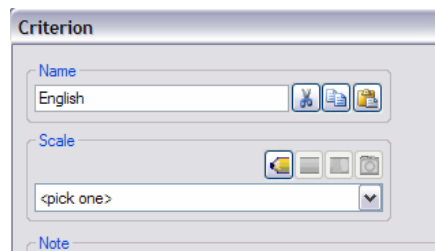
Incidentally, this GPA computer is hardly a trivial example. It is the same math used in industrial and government RFP evaluations, audit check lists, product comparisons or merit pay ratings, which are all common weighted average evaluation systems. DecisionPad automates them neatly, with flexibility in scoring ranges or points to match what your organization is used to, plus new insight from graphics and what-if analysis.

To build a GPA computer select a *New Blank Decision* from the startup or *File* menu.

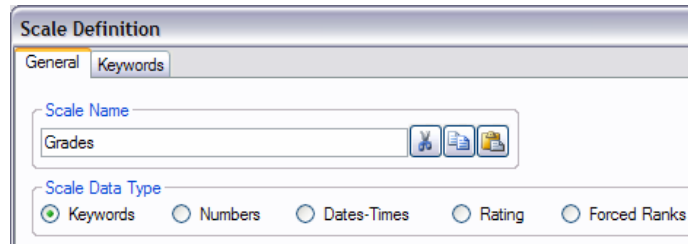
Select the *Project, Scoring* menu and set the *Scoring* range to 0 to 4 instead of the default 0 to 10. Click OK.



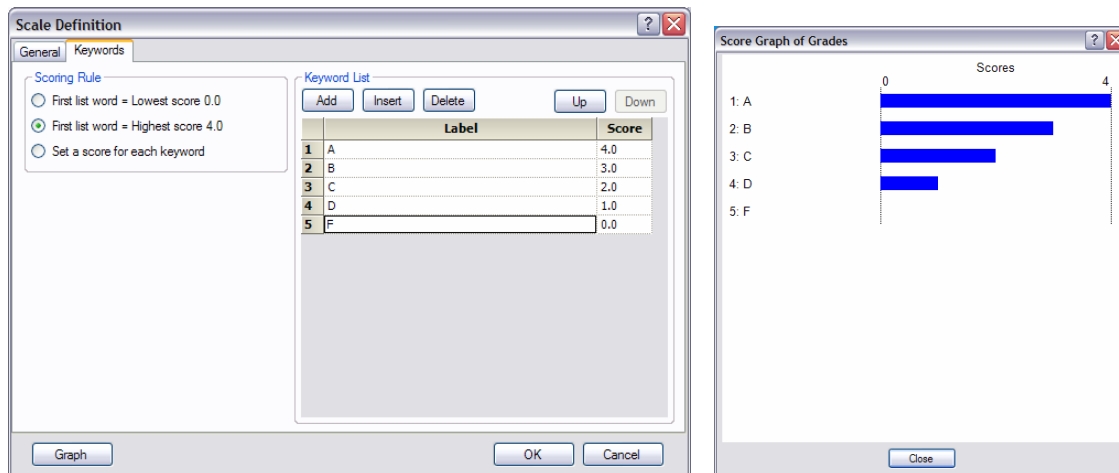
Double-click on *Add* in the criteria tree section, type English into the name:



Click the scale insert pencil point button which brings up the scale definition dialog:



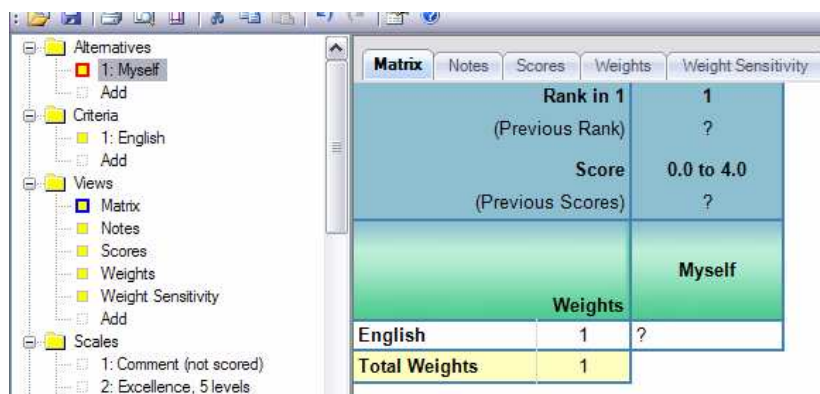
Name it Grades and then select the *Keywords* tab. Set the *first list word = highest score* and use the *Add* button to fill in the grades (A, B, C, D, and F):



Clicking the *Graph* button – optional – gets the view at the right, a handy cross-check on the settings or way to explain them to others.

Click Close, Ok and Ok to accept the scale and criterion.

Now put yourself into the picture by doing alternative *Add* and type in your name. The tree and matrix should look like this:



Given that we do not know the grade yet, your overall GPA (the score) could be 0 to 4. Give yourself an 'A' for English using the pulldown list.

Matrix	Notes	Scores	Weights	Weight Sensitivity
Rank in 1		1		
(Previous Rank)		1		
Score		4.0		
(Previous Scores)		0.0 to 4.0		
Weights		Myself		
English	1	A		
Total Weights	1			

Your GPA is 4.0. The class 'weight' is only 1 unit – set it to 4 units or 'credits' and the GPA stays the same as you would expect. Remember you have to move the cursor out of the new weight cell in order for the matrix to be recomputed.

Unfortunately you also took a French class that met early Saturday mornings, not your best time after Friday night parties. Add a new criterion for French with the previously defined Grades scale, 5 units and a grade of 'C'. The new GPA is 2.9:

Matrix	Notes	Scores	Weights	Weight Sensitivity
Rank in 1		1		
(Previous Rank)		1		
Score		2.9		
(Previous Scores)		1.8 to 4.0		
Weights		Myself		
English	4	A		
French	5	C		
Total Weights	9			

The *Previous Scores*, before entering the grade, showed the possible range of the GPA as 1.8 to 4.0 pending an unknown 5-unit French grade given a 4-unit A in English.

The rating and forced rank scales are much the same as keywords, just with a different way of labeling the bins. That's all for our GPA computer.

Important Concept: scoring rules should use as much or as little of the 10-point range as expresses how different or similar the alternatives are for your purposes. The importance is handled by the weights. Thus for each criterion:

- Scores = benefit or cost differences between alternatives
- Weight = importance differences relative to other criteria

The emphasis is on differences – all of the computations are relative which is why you can change the scoring range or use points to present results in a format people will be more comfortable with, yet have the same ranking results.

Number or Date scales set the scores based on the values and you have several ways to specify how the scoring will work. The two built-in number scales go from 0 to maximum, either making maximum best or 0 best. The use of minimum and maximum for number or earliest and latest date scales can be trickier than keywords. The next exercise explores this around the most common item in decision matrices about buying things: price.

Let's build a new DecisionPad to experiment with. Select *File, New Blank Decision* to clear out the GPA computer.

Use the Alternatives *Add* to put in three: Cheap, Middle and Luxury.

Select Criterion *Add*, name it Price and use the built-in *Numbers 0-to-Max (0 best)* scale. In the Matrix type in the values 2500, 3500 and 5000 in turn. The commas are optional when you type new numbers. You will need to leave a value cell with the enter key, tab key or by clicking in another cell before the matrix will be updated.

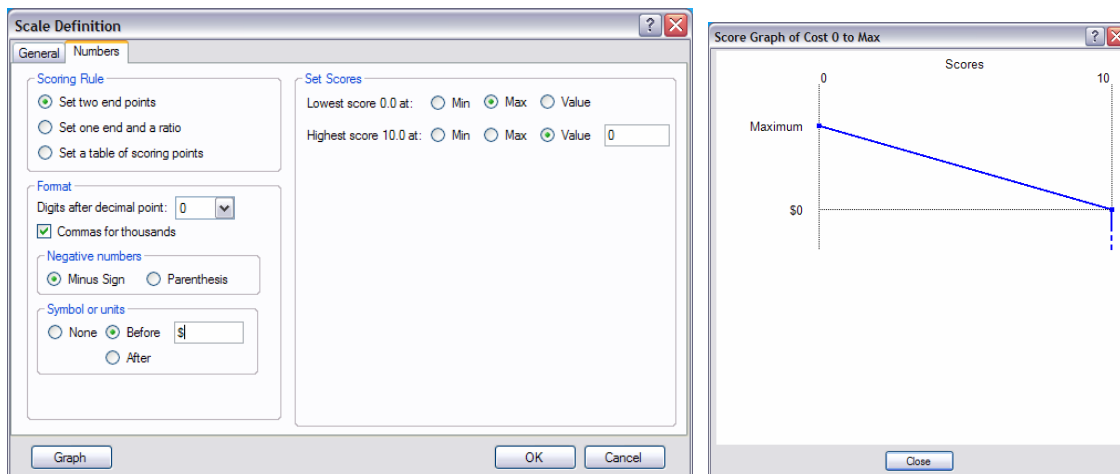
Matrix	Notes	Scores	Weights	Weight Sensitivity
Rank in 3 (Previous Rank)		1	2	3
		2	3	1
Score (Previous Scores)		5.0	3.0	0.0
		2.9	0.0	0.0 to 10.0
Weights		Cheap	Middle	Luxury
Price	1	2,500	3,500	5,000
Total Weights	1			

The scores and ranks favor the lowest prices since we said 0 (free) was best.

This is a good handy scale for most purposes in buying equipment as it will make the spread of scores match the overall cost range. Here the 5-point difference between the \$2500 and \$5000 items is about like the difference between Excellent and Fair in the built-in subjective scale, or roughly the range between a Yes and No. Remember it's the difference in scores that matters, not the fact that the lowest price got a 5.

We generally don't use all 10 points on "hard data" (like cost or specifications) because people tend to not use all 10 points for subjective ratings, such as quality, service or skills. Thus the built-in 0-to-Max for cost generally works fine.

Before we investigate the scoring further, let's customize the scale to add a dollar sign to the values. Double-click the Price criterion in the tree to get its definition dialog, and then click the scale camera button to copy the built-in scale. In the scale dialog change the name to Cost 0-max. On the numbers tab, change *Symbol or units* from *None* to *Before* and type in the dollar sign:



We used the *Graph* button to get the display at the right. More on this in a moment. Meanwhile click Ok twice to get back to the worksheet with the new scale and dollar signs.

	Weights	Cheap	Middle	Luxury
Price	1	\$2,500	\$3,500	\$5,000

In the score graph above you will see that the scoring line ends at Maximum but shows a dashed extension below \$0. This is because any time the number or date goes outside specific value limits the score is the same as at the edge. Try this by typing -1000 into one of the values. It will be scored 10.0 like free would be. Remember to leave the cell with enter, tab or the mouse so the new setting can take effect. You can highlight the whole entry and just type the new number without the \$ or commas.

Sometimes you are more sensitive to even small cost differences, say when you are buying many pieces of equipment or large quantities of parts.

Lets see what happens if we enter some prices with smaller ranges: type 2500, 2560 and 2620 into the alternatives.

Matrix	Notes	Scores	Weights	Weight Sensitivity
Rank in 3		1	2	3
(Previous Rank)		1	2	3
Score		0.5	0.2	0.0
(Previous Scores)		5.0	4.9	0.0
		Cheap	Middle	Luxury
Weights				
Price	1	\$2,500	\$2,560	\$2,620
Total Weights	1			

There is only a 0.5 point scoring difference, which will hardly affect the decision when there are other criteria in play. This insignificant difference would be appropriate for buying one item. Not so when you are about to buy 1,000 units. The difference between a bid of \$2500 and \$2620 for each one becomes very important: \$120,000 important! You probably want to use the whole 10 scoring point range for these smaller price differences.

Double-click the criterion, click the pencil point for a new scale, give it a name like Min-Max and select the *Numbers* scale data type. The *Keyword* tab is replaced by a *Numbers* tab. Select it. Pick *Set two end points*, set the lowest score to *Minimum* and highest score to *Maximum* and add the \$ sign. Now your scale and its graph will look like:

The image shows two windows from a software application. The left window is titled "Scale Definition" and has a "Numbers" tab selected. Under "Scoring Rule", the "Set two end points" option is selected. Under "Set Scores", "Lowest score 0.0 at:" has "Max" selected and "Highest score 10.0 at:" has "Min" selected. Under "Format", "Digits after decimal point:" is set to 0, "Commas for thousands" is checked, "Negative numbers" has "Minus Sign" selected, and "Symbol or units" has "Before" selected with "\$" in the input field. The right window is titled "Score Graph of min-max" and shows a graph with a vertical axis labeled "Scores" ranging from 0 to 10. A blue line starts at a point labeled "Maximum" on the y-axis and ends at a point labeled "Minimum" on the x-axis. A dashed line extends from the "Maximum" point down to the 0 mark on the y-axis.

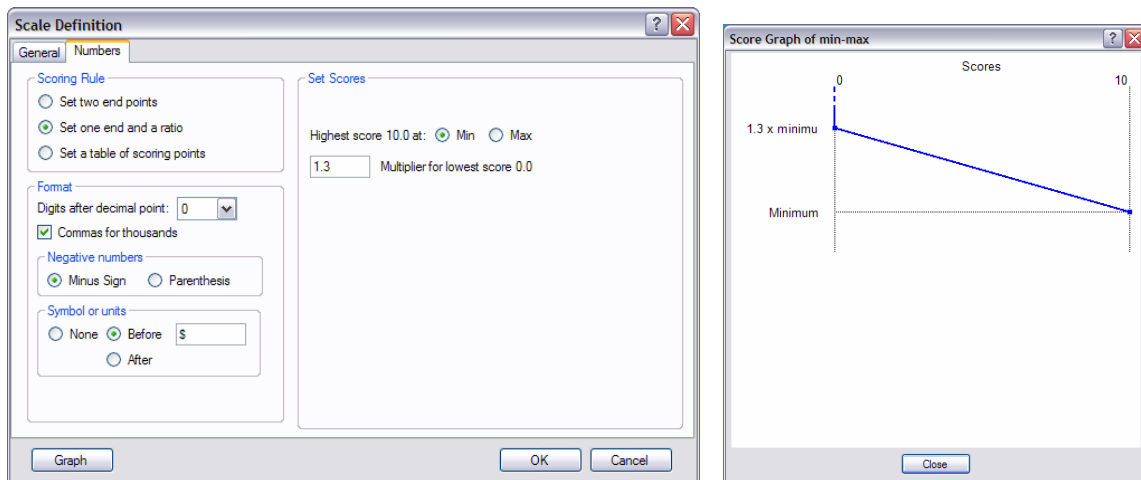
After you click OK's to get back to the matrix, the score range is 0 to 10 for this price spread.

Next try a case where Min/Max gives a false valuation – an overinflated effect on the results. Type 2500, 2501, 2502 into the three alternatives. Decision Pad has dutifully applied the full 10 scoring points to the \$2 difference out of \$2500. This probably overstates the value of the \$2 price difference no matter how many you buy - \$2 out of \$2500 is very unlikely to be as valuable as the difference between Excellent and Unacceptable on rating services or features.

Conclusion? Min and Max are certainly handy, but please use them with a bit of care! Another drawback of using min-max is that the partial data results will be misleading since their scores are pegged to limits that may not be the final ones.

Often a better solution is to either set both end points to cover the explicit range of prices you expect or to use the ratio option tied to the lowest price or a set price.

Let's try a ratio setup here. Double-click the Min-Max scale definition in the tree to edit it, select the *Numbers* tab again and change the scoring rule to *Set one end and a ratio*. You can say you want the lowest price to score best but that anything up to some multiplier, like 1.3, will be considered although at that point the score for this 30% higher price would be zero. Now the tab and the graph look like this:



Click OKs to accept. Our \$2 spread now all has scores of 10, much more sensible for the 2 dollar difference.

In a real decision, even an alternative with a price at or above a 30% premium, getting a score of zero on that price criterion, might still end up ranked #1 because of a strong performance over its rivals in other areas such as specifications, quality or support. Decisions are all about tradeoffs.

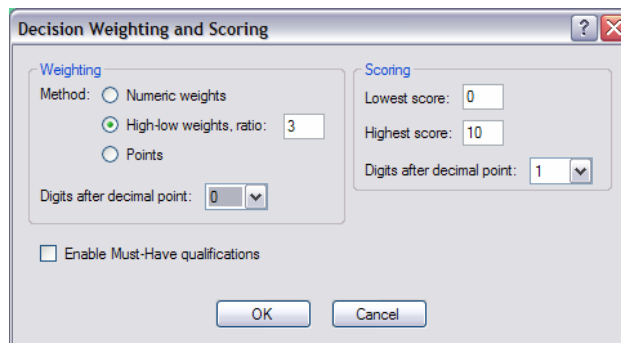
Weights as Numbers, Points or Words

Open the file Tutorial-3.dp3 which is a grouped criteria case with the impact arrows turned on:

		Rank in 3 (Previous Rank)	1	3	2
		Score (Previous Scores)	6.4	5.1	6.1
			?	?	?
		Weights	↓Central Laser	↓Four Lasers	↓15 Individual Inkjets
Finance		64			
└	Retail Price	10	\$6,999	↓ \$3,596	↑ \$5,985
└	Financing Plans	15	Yes	Yes	No
└	Cost per Page - Color	29	57 ¢	84 ¢	↓ 38 ¢
└	Yearly Maintenance Fees	10	Good	Fair	Poor
Features		27			
└	Print Speed	20	35 ppm	↑ 25 ppm	20 ppm
└	Duplex Printing	7	Yes	Yes	Yes
Support and Human Factors		9			
└	Ease of Use	9	Hard	Average	Easy
Total Weights		100			

When we've worked with Weights previously, we've used numbers to set their relative importance. DecisionPad allows other ways to set the weights, which may be more intuitive for some people.

Let's try it with words instead of numbers. Go to the *Projects, Scoring* menu and change from *Numeric weights* to *High-low weights*. Click OK:

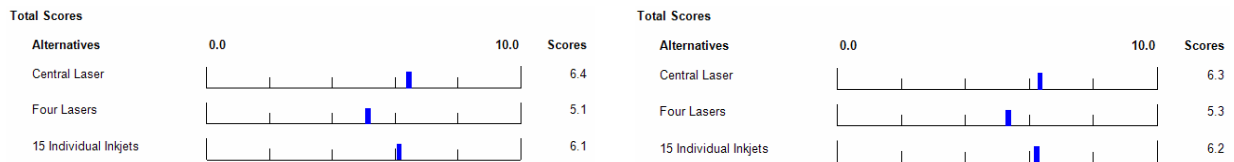


Now the matrix looks like this:

		1	3	2
Rank in 3		?	?	?
(Previous Rank)				
Score		6.3	5.3	6.2
(Previous Scores)		?	?	?
		Central Laser	Four Lasers	15 Individual Inkjets
Weights				
Finance V-High				
— Retail Price	V-Low	\$6,999	\$3,596	↑ \$5,985
— Financing Plans	Medium	Yes	Yes	No
— Cost per Page - Color	V-High	57 ¢	84 ¢	↓ 38 ¢
— Yearly Maintenance Fees	V-Low	Good	Fair	Poor
Features Medium				
— Print Speed	V-High	35 ppm	↑ 25 ppm	20 ppm
— Duplex Printing	V-Low	Yes	Yes	Yes
Support and Human Factors V-Low				
— Ease of Use	V-High	Hard	↓ Average	Easy

The weights have been converted to words assuming that Very High (V-High) is 3 times Very Low (V-Low), which is what the default *Ratio* specifies in the previous dialog.

When making this change, you lose some precision, but gain some ease of use for people to rank weights. Let's see the actual effect in this case when we made this change. Comparing the Scores Report for these two cases, numbers left and words right:



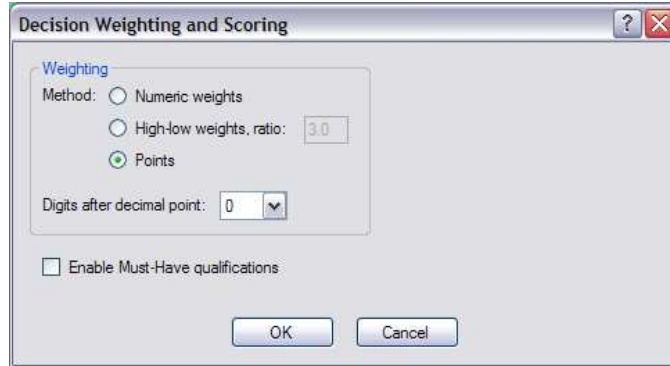
Since the conversion is an inexact one (fewer words than numbers to work with) the scores have changed a little but the overall rankings are the same.

Unlike the numeric weights there is no total and the groups are not subtotals. The weights at the group level are one set of weights, and then the criteria are independently weighted within each group. The easiest way to see this is to change Ease of Use from V- High to V- Low. Same exact scores and ranks because it is the only criterion in the group so the criterion's high or low does not matter – its effect on the scores is controlled by its V-Low group weight:

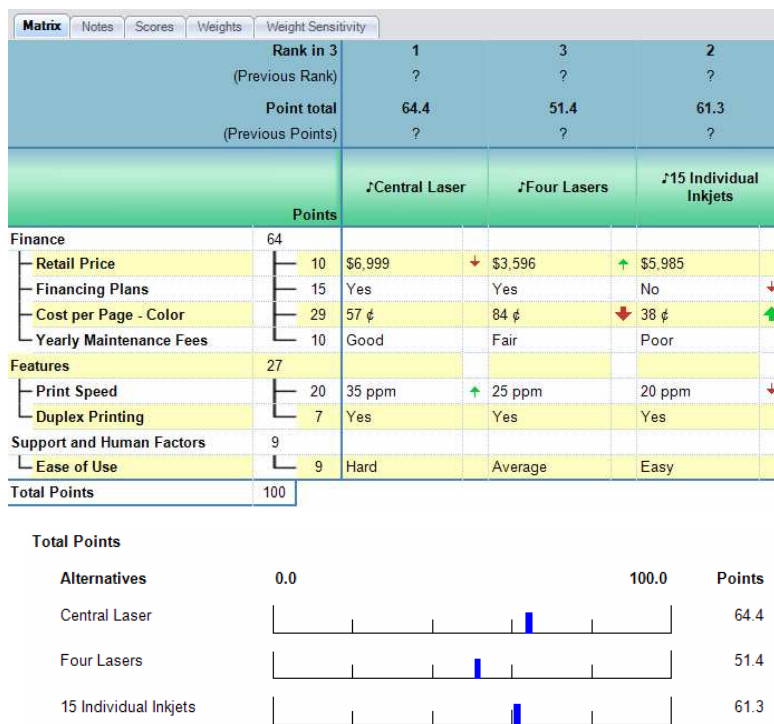
Rank in 3	1	3	2
(Previous Rank)	1	3	2
Score	6.3	5.3	6.2
(Previous Scores)	6.3	5.3	6.2

Let's move on to discussing setting weights by points. It will be clearer if we start with a clean copy of Tutorial-3. Please close your current working version and re-open it from the Samples folder. It should look like the first page of this section again. Take a look at your Scores (at the top of the matrix) before you change it – notice they are all between zero and 10.

With *Project*, *Scoring* change the setup to *Points*. Click OK:



The scoring side has gone away from the dialog, but when we get back to the Matrix it looks almost the same except for the scores which have become points. The rankings are exactly the same:



So what changed? Mathematically, nothing really, because all of these computations are relative. Except for roundoff details, we are just changing the way people relate to the tradeoffs.

In this case, our Total Points (the old Weights total) is still 100. The criterion weights became the possible points for each one. This means that all the scores are percentages – our top ranked choice has earned 64.4% of the possible 100 points available.

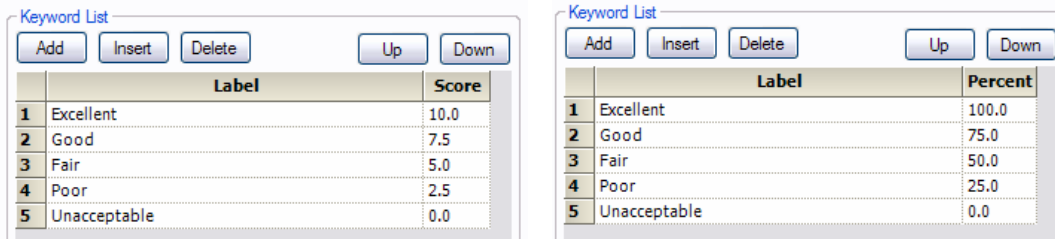
If your company already uses a vendor evaluation system that includes 250 possible points, the Point total at the top will be between 0 and 250, once you set up the matrix to have 250 Total Points on the bottom left. When people are familiar with the old point values, like “over 210

points is pretty good”, using the same points makes acceptance of the DecisionPad version more comfortable than switching to scores would be.

If you play around with the criteria points and end up with an odd number of total points, you can always come back to the bottom left, change that value to 100, and your Point calculations will be percentages again.

Another way of looking at it is that with numeric weights DecisionPad normalized the weighted totals back to scores, while here it left them totaled as points. A score of 6.4 out of 10 becomes a point total of 64.4 out of 100. But it’s all relative so the rankings work out the same.

One other difference you will see is in the scale setups:



The image shows two side-by-side screenshots of the 'Keyword List' interface. Both screenshots have a title bar 'Keyword List' and buttons for 'Add', 'Insert', 'Delete', 'Up', and 'Down'. The left screenshot shows a table with two columns: 'Label' and 'Score'. The right screenshot shows a table with two columns: 'Label' and 'Percent'.

	Label	Score
1	Excellent	10.0
2	Good	7.5
3	Fair	5.0
4	Poor	2.5
5	Unacceptable	0.0

	Label	Percent
1	Excellent	100.0
2	Good	75.0
3	Fair	50.0
4	Poor	25.0
5	Unacceptable	0.0

On the left the values are tied to scores for Numeric or Word weights; on the right it is the percentage applied to each criterion’s points.

Thank you for working with the DecisionPad tutorials!