

Developing Process Flow Diagrams with SAS® 6.11

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Process flow diagrams are an integral part of statistical process control methodology. By graphically displaying inputs, actions, and outputs, a process flow diagram can express detailed knowledge of a system. Process flow diagrams help improve process performance by identifying potential control points, process flow, and interaction between process steps.

SAS/AF® Release 6.11 provides a new frame object for developing process flow diagrams. This frame object enables the graphical representation of simple and complex diagrams. This paper will present examples of how SAS/AF software can be used to create process flow diagrams.

Process Flow Diagrams

In order to control a process, we must know how the process works. We need to know what materials are used, what actions are performed, where tests are made, and where the finished product ends up. This product may be a physical product like a chair or any other factory operation, or it may be a service like billing procedures or office operations.

PFDs in SAS Release 6.11

The Process Flow Diagram class in Release 6.11 allows you to create a diagram consisting of the standard symbols, arrows, and text used in process flow diagrams. Utilizing the interactive environment of the Process Flow Diagram object, the drawing area is used in both the build and run-time environments. Additional complexity may be added to the diagram by creating sub-diagrams or by writing SCL programs that can be attached to each node and arrow in the diagram.

A Simple Process Flow Diagram

Burr (1993) gives an example of a process flow diagram for toasting bread. The raw material in our process is the bread, the

toaster is the machine. The process starts by gathering the bread, putting it in the toaster, and checking the setting. If the setting is to our liking, we depress the lever and wait for the toast to pop up. If the toast is edible, we apply butter and eat it. If the toast is not ok when it pops up, we do one of five things. If it is too well done, we scrape it off and eat it, throw it out, give it to the dog, or eat it as is. If the toast has not been warmed sufficiently, we adjust the setting and depress the lever again.

To diagram this process using SAS/AF, we begin as follows: In the frame, we create and fill a region with the process flow diagram object. Select OK when the attributes window appears to start a new diagram. Figure 1 shows the results.

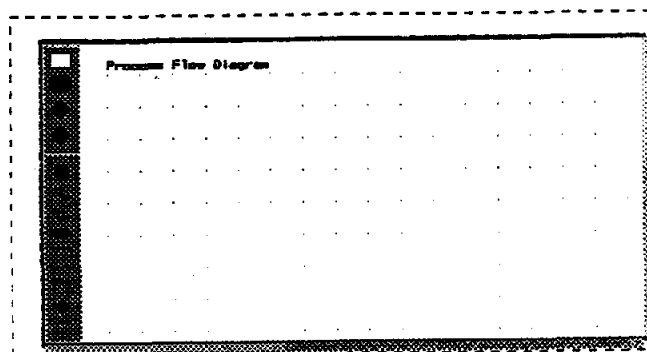


Figure 1.

Creating the diagram in the build environment is easily done by selecting the type of node desired from the palette and dragging it onto the drawing area. Arrows can be drawn between nodes by dragging from the inside edge of one node to the inside node of another. The type of arrow to be drawn is selected in the tool palette. Text is added to each node by selecting the node and typing. Nodes and arrows can be deleted by selecting them, and pressing the delete key.

Returning to our bread toasting process, we begin by dragging the node used to signify the start of the process onto the drawing area

and typing the text that we want displayed. We next select the node for the second step in the process, drag it onto the drawing area, and type the text for this node. We connect the two nodes with an arrow by dragging from the inside corner of the first node to the inside corner of the second node.

The third node in our process is a decision node. Selecting the diamond-shaped node signifying a decision point, we drag it onto the drawing area, and start typing to label the node. Figure 2 shows what our process flow diagram looks like at this point.

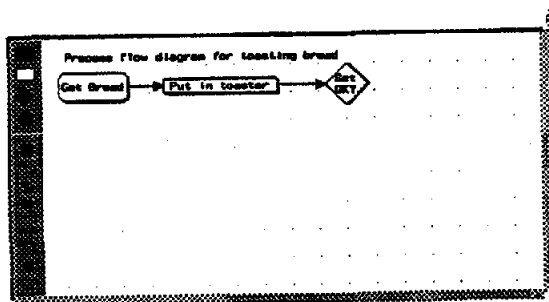


Figure 2.

Continuing this procedure, we create the entire process flow diagram for toasting bread. Adding text at the decision nodes is done by clicking on the point of the arrow where you want the text to appear, then typing the text. Figure 3 shows the completed process flow diagram for toasting bread.

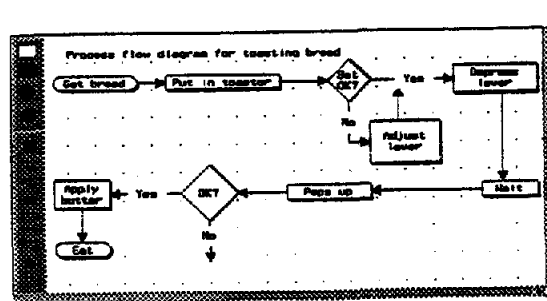


Figure 3.

Adding Sub-Diagrams

It is easy to add additional detail to your process flow diagram without making the diagram difficult to read by using sub-diagrams. A sub-diagram can be created and attached to a node of the main diagram by simply double-

clicking on an existing node. The process for drawing the nodes and arrows for the sub-diagram is exactly the same as for the main diagram. The title in the upper left-hand corner of the sub-diagram serves as a path name. To return to the main diagram, simply click on the go-back arrow on the tool bar palette. You can also return by double-clicking on the path name.

Back in the main diagram, you will notice an icon in the lower right-hand corner of nodes that have a sub-diagram associated with them. You can also drill down to the sub-diagram by simply clicking on the icon.

Let's add a sub-diagram to our toasting bread diagram. When we reach our first decision node, we check to see if the toaster is set to the appropriate setting. If it is not, we adjust the lever and then toast bread. But how do we adjust the lever? If it is set too high, which will result in burned toast, we want to adjust the lever to a lighter setting. Alternatively, if it is set too low, we want to set the lever higher. We can make a sub-diagram to the Adjust Lever node that will diagram these choices. Figure 4 shows the main process flow diagram after the sub-diagram has been added, and Figure 5 shows the sub-diagram.

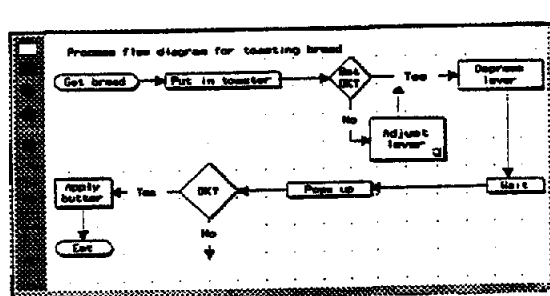


Figure 4.

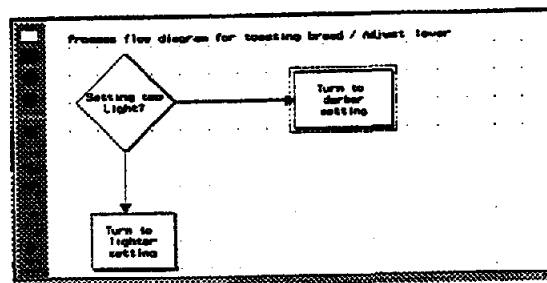


Figure 5.

Run-Time Processing

Run-time processing can also be added to the Process Flow Diagram Object. This allows the diagram to display SAS/GRAPH ® outputs or to modify the diagram. By associating the name of the node with a section of an SCL program, the appropriate portion of the program will be executed when the node is selected. The Process Flow Diagram Class contains methods that will add arrows and nodes, return information about specific arrows and nodes, and get and set attributes for the arrows and nodes.

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Conclusion

SAS/AF Release 6.11 provides an easy to use frame object to develop process flow diagrams. The object can be used in both the build and run-time environments, and labeled sections of SCL code can be attached to the nodes and arrows for additional processing. Complex or large diagrams can be simplified by creating sub-diagrams that users can access by drilling down.

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