ELECTRONIC DOCUMENT CONSIDERATIONS

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With the convenience of the Internet for posting course documents and the popularity of online courses, instructors need to be able to create documents that can be accessed using any hardware or software platform. In addition, these documents must be accessible for all, whether using high speed wireless or DSL, for example, or lower speed dial-up. Thus, the software used to create the documents becomes a consideration as well as the elements contained in the document itself. Access to software can limit the use of documents just as file size can limit one's access.

While college/university recommendations regarding student-purchase for software may prompt one to select a particular document preparation system such as MS Word or Corel WordPerfect, students may still choose to purchase other software such as MS Works or to use open source software such as OpenOffice's Writer. It is important to remember that once one posts a document on the Internet, anyone can access and use the article: this file becomes a resource for all users of the Internet and, as a resource, users should be able to open the file in order to use the information. Although one may choose to prepare multiple versions of documents, this is not practical. In addition, even though software makers claim that their products are compatible, document preparation systems may not be able to open documents created using other systems. For example, one will encounter problems when trying to open a document created using MS Works with MS Word or Corel Wordperfect even though both of these systems allow one to save documents in a MS Works format. Another problem with these documents is that they are not static: elements in text or presentation documents such as images containing graphs or equations, for example, may be accidentally deleted by the user. Finally, documents may open differently based on the user's hardware and software settings.

A solution to these problems is creating static documents using portable document format (pdf). The portable document format captures the elements of a printed document as an electronic image that can be viewed printed, and navigated without hardware or software platform conflicts. Since pdf files are static, all elements of the document including images and hyperlinks are preserved and cannot be accidentally altered by the user. Pdf files can be created using software that can be purchased such as Adobe Acrobat(http://www.adobe.com/products/acrobat/) which integrates itself seamlessly into MS Office or deskPDF (http://www.docudesk.com), or free software such as PrimoPDF (http://www.primopdf.com/) or Pdf995 (http://www.pdf995.com) as well as from within document preparation systems such as Corel WordPerfect and PCTeX (http://www.pctex.com). Static documents in pdf files created using any software can be opened using the free software Adobe Reader

(http://www.adobe.com/products/acrobat/readstep2_allversions.html) available for a variety of platforms including Windows, Macintosh, Unix, and Linux, as well as mobile devices such as Palm and Pocket PC.

Another option is posting documents as html. However, unlike a pdf file for which the format is static, a document saved as html and displayed in a web browser is affected by the user's software settings. That is, the display of the document is affected by such things as the user's selected text size and window size, for example.

Another consideration is the creation of readable, comprehensible graphs for course documents such as assignments, quizzes, and examinations as well as the student's need to be able to make graphs for projects and assignments to be turned in electronically or posted as part of online assignments/presentations. These do not necessitate the use of specialized software: the readily available software such as MS Excel and the free software such as Winplot will suffice for graphing for developmental mathematics, college algebra, Precalculus, calculus, and statistics courses.

One consideration in adding elements to MS Word documents, for example, is the size of the element. The term "element" is used here as opposed to image or graphic since, frequently, users copy elements from software such as MS Excel and paste these elements into documents. While some elements may paste into documents as images of small size such as gif (graphic interchange format), jpeg (joint photographic experts group), or png (portable network graphics) images, other elements may not save as images, such as graphs copied directly from MS Excel and pasted directed into MS Word documents; paste special must be used to convert such elements as images/pictures. When a graph is copied directly from MS Excel and pasted directly into MS Word, a copy of the the MS Excel document is saved as part of this document; although this allows one to directly edit the graph element within MS Excel, the size of the MS Word document is increased.

To explore this aspect of MS Excel, one can create MS Word documents into which several MS Excel graphs are directly pasted. Suppose one creates a MS Excel workbook that contains one graph and suppose that the size of this workbook is 33 KB as displayed in Figure 1 below. If one selects this graph and pastes this graph directly into a MS Word document that contains no text, the size of this file will be larger than the original MS Excel file: the file size is 69 KB as displayed in Figure 1. If one saves two, three, or four copies of this same graph in a MS Word file, the file size becomes 127 KB, 192 KB, or 250 KB, respectively. Of course, as one adds text to this file, the file size increases as well.

If one pastes MS Excel graph elements in a MS Word document using the Paste Special option on the Edit menu and select Picture option in the Paste Special dialog box then the file size for the MS Word document containing one, two, and even three of the same images will be smaller than the original MS Excel document from which the image was created. Figure 2 displays the file size for the original MS Excel file used for this

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example, 33 KB, and the MS Word documents containing one, two, three, and four images produced using the Paste Special option to include elements copied from the MS Excel document. The MS Word documents containing images produced using the Paste Special option are considerably smaller than before: MS Word files containing one, two, three, or four graphs are 24 KB, 27 KB, 30 KB, or 33 KB, respectively, in size. So, using the Paste Special option to save the MS Excel graph as a picture only increases the file size by 3 KB for each picture added to the file. Of course, the size of the file is affected
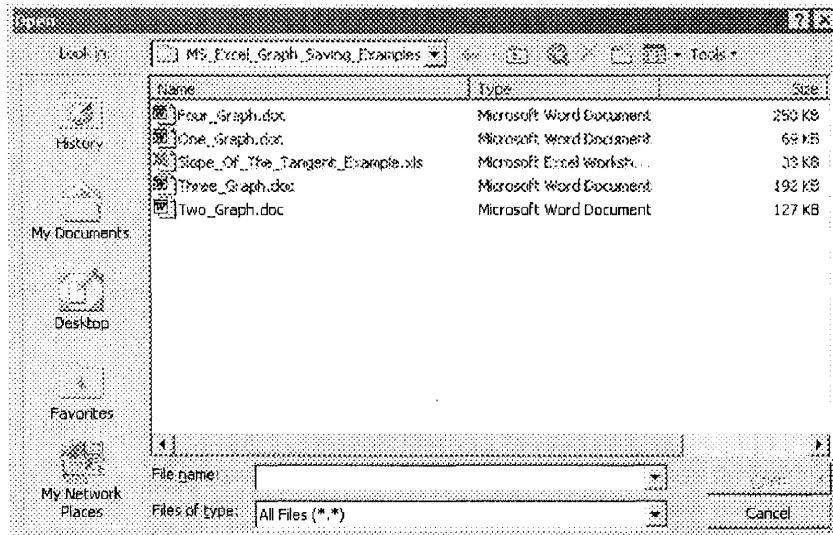

Figure 1: Comparison of file sizes for files containing MS Excel graph elements

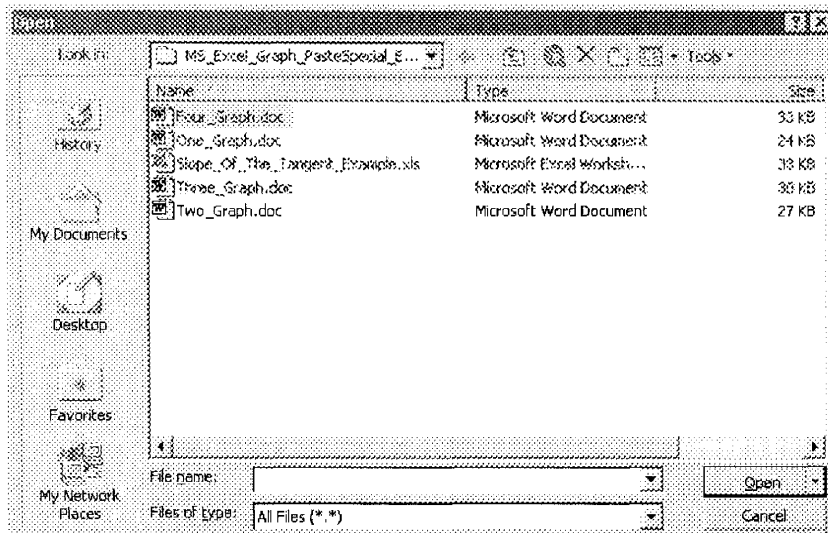by the amount of text and other elements added to the file as well.

Figure 2: Comparison of file sizes for files containing MS Excel graph elements
pasted using paste special

Double left-clicking any of the MS Excel graphs copied and pasted directly into MS Word files allows one to change the attributes of the graphs as well as the data used to generate these graphs. However, if one uses Paste Special, one cannot edit the graphs: the graph is saved as a fixed image. So, although using Paste Special does not allow one to edit/update the graph image as one changes the original MS Excel file, the MS Word file will not become considerably larger as one includes additional graphic elements.

Figure 3: Comparison of file sizes for various image types

When creating images with other software, whether graphs or images created with graphics software such as Macromedia Fireworks or image capture software such as TechSmith's SnagIT, it is important to consider the file type that one uses. File types such as Tagged Image File (tif), Windows Bitmap (bmp), Windows Metafile Format (wmf), and Windows Enhanced Metafile Format (emf) have a very large file size in comparison to graphics saved as JPEG, GIF, and PNG files, for example; these file types are mentioned since file size is important for both print documents and for files posted on the Internet.

Figure 3 displays the file size for an image created with TechSmith's SnagIT and saved in various graphic formats. Comparing these images, one can see that the GIF and PNG images have a file size of 5 KB and the JPEG image has a file size of 19 KB; these are the smallest, and they are considerably smaller than the rest. The file size for the TIF image is 576 KB while the file size for the BMP, WMF, and EMF images are all 577 KB. Using TIF, BMP, WMF, and EMF images will considerably increase the size of the file into which they are inserted.

So, when using graphics in a MS Word file, for example, or any file in which text and graphics are to be used, one must be careful to consider how the software saves the file since this will affect the size of the document that is created. For software such as MS

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Excel, it is important to use the Paste Special option in MS Word, especially if one plans to use several graphs created using MS Excel. If one plans to use several images in a print or web document, one should avoid using image files such as BMP, EMF, TIF, and WMF since they will increase the file size greatly in comparison to file types such as GIF, JPEG, and PNG.
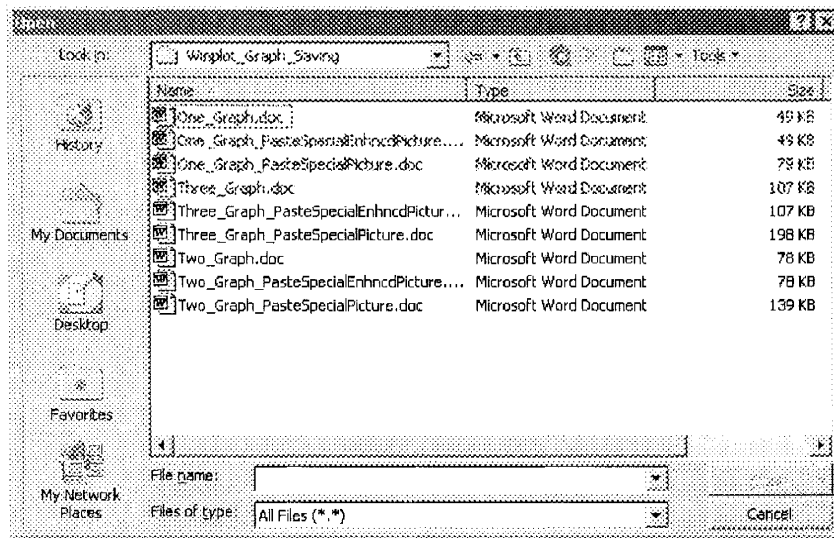

Figure 4: File size comparison for MS Word files containing Winplot graphs

So, what about creating graphs using software such as Winplot and pasting these graphs into a MS Word document? Winplot allows one to copy a graph directly to the Clipboard and then past the image directly into MS Word, to paste the image as a picture into MS Word, or to paste the image into MS Word as an enhanced metafile picture. Figure 4 contains a comparison of file sizes for each of these options. As listed below, the file size

Direct save from Winplot
- One graph: 49 KB
- Two graphs: 78 KB
- Three graphs: 107 KB

Paste Special as enhanced metafile picture
- One graph: 49 KB
- Two graphs: 78 KB
- Three graphs: 107 KB

Paste Special as picture
- One graph: 79 KB
- Two graphs: 139 KB
- Three graphs: 198 KB

For MS Word files into which Winplot images are directly inserted or inserted as enhanced metafile pictures is the same while the file size for documents into which images are inserted using the Paste Special option is larger. Thus, for Winplot, one does not need to use the Paste Special option to insert graph images.

Therefore, it is important to explore the options for inserting elements, in particular graphic elements, into documents for each software that one might use to create elements for a document. The file size of the document is affected by the type of elements that are inserted and the way in which these elements are inserted in the document.

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