

CMPSCI 105 Midterm Exam Solution Fall 2009

GENERAL KNOWLEDGE

<1> 20 Points – (1 point each) – Fill in your answer into the box at the left side of each question. Show your work on the back of a page if you want us to consider partial credit.

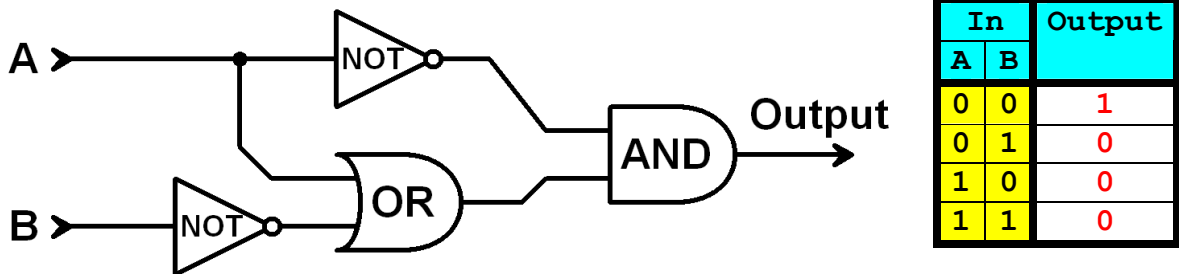
FALSE	1. True or False: A 3½-inch diskette is a “hard disk”. A diskette is a “floppy” disk, not a hard disk.
FALSE	2. True or False: A USB flash drive is a “hard disk”. A hard disk is a whirling piece of aluminum coated with magnetic material, usually mounted inside the computer’s chassis. A flash drive is completely solid-state, with no moving parts.
FALSE	3. True or False: The binary value of the number $\sqrt{2}$ <i>can</i> be stored into computer memory with its full precision. The square-root of 2 is an irrational number, which means that its digits go on forever without repeating. Its approximate value is 1.414213562... You cannot put an infinite number of digits into a finite number of bits.
FALSE	4. True or False: With one byte you can represent all <i>signed decimal</i> values between -255 and +255, but no other values. With one byte the unsigned range is 0...255, but with the signed representation half of those values are interpreted as negative, giving a signed range of -128...+127.
$2^6-1 = 63$	5. What is the largest <i>unsigned</i> number that will fit into 6 bits? For unsigned numbers, the largest value for N bits is 2^N-1 , and in this case N=6. There are $2^6=64$ patterns with 6 bits, but one of them is zero, so the largest unsigned value is $64-1=63$.
1101	6. Convert the decimal (base 10) number 13 into <i>binary</i> (base 2). $13 \div 2 = 6 \text{ R } 1$ (the rightmost bit) $6 \div 2 = 3 \text{ R } 0$ $3 \div 2 = 1 \text{ R } 1$ $1 \div 2 = 0 \text{ R } 1$ (the leftmost bit)
D	7. Convert the decimal (base 10) number 13 into <i>hexadecimal</i> (base 16). This is a simple matter of looking the value up in the table of hex digits, since it is in the range 0...15 (decimal) or 0...F (hex).
15	8. Convert the decimal (base 10) number 13 into <i>octal</i> (base 8). $13 \div 8 = 1 \text{ R } 5$ (the rightmost digit) $1 \div 8 = 0 \text{ R } 1$ (the leftmost digit) You could also take the binary answer from problem 6 (above) and use the bit partitioning method, splitting 1101 into 001-101, and then convert each bit pattern back to octal: binary 001 has the octal value 1, and binary 101 has the octal value 5.

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111	<p>9. Convert the binary (base 2) number 1101111_2 into <i>decimal</i> (base 10).</p> <p>The weights of the seven bit positions are: 64-32-16-8-4-2-1, and there are 1-bits in every position except the 16-position. The result is then $64 + 32 + 8 + 4 + 2 + 1 = 111$ (one hundred eleven).</p>
6F	<p>10. Convert the binary (base 2) number 1101111_2 into <i>hexadecimal</i> (base 16) using the <i>bit-partitioning</i> method.</p> <p>Partition the number into packets of four bits, padding the leftmost packet with 0-bits as necessary. For this number the packets are 0110 and 1111. Converting 0110 gives us 6, and converting 1111 gives us 15, which is F in hexadecimal.</p>
157	<p>11. Convert the binary (base 2) number 1101111_2 into <i>octal</i> (base 8) using the <i>bit-partitioning</i> method.</p> <p>Partition the number into packets of three bits, padding the leftmost packet with 0-bits as necessary. For this number the packets are 001, 101, and 111. Converting 001 gives us 1, converting 101 gives us 5, and converting 111 gives us 7.</p>
11011110	<p>12. What is the <i>sum in binary</i> (base 2) of the two binary numbers 1101111_2 and 1101111_2? (Adding the number to itself.)</p> <p>Add the rightmost bits: $1+1=0$ with a carry. Add the next rightmost bits plus the carry: $1+1+1=1$ with a carry. Continue for all the bits. Adding a number to itself is equivalent to multiplying it by 2, which has the value 10 in binary. In decimal, multiplying by 10 is the same as adding a zero to the right end. In binary, multiplying by 10 does the same thing, so the final pattern is the same as the original number plus a zero added to the right end.</p>
$6-2i$	<p>13. What is the <i>sum</i> of complex numbers $4+3i$ and $2-5i$?</p> <p>Add the real components: $4 + 2 = 6$. Add the imaginary components $3i - 5i = -2i$.</p>
$23-14i$	<p>14. What is the <i>product</i> of complex numbers $4+3i$ and $2-5i$?</p> <p>Use the “FOIL” method: $4 \times 2 = 8$, $4 \times (-5i) = -20i$, $3i \times 2 = 6i$, and $3i \times -5i = -15i^2$, but this last term is $+15$ since $i^2 = -1$. Gathering all the terms gives $8 + 15 = 23$, $-20i + 6i = -14i$.</p>
$6.537995E3$ or $+6.537995E+3$	<p>15. Write the number 6537.995 in <i>scientific notation</i> the way it must be entered into a computer.</p> <p>Remember that entering numbers in scientific notation has to be accomplished without superscripts or special characters, so you cannot enter 6.537995×10^3. The number has to be typed in using only regular characters, and so the E has the meaning “times ten to the power of” in the string.</p>
$-6.537995E-2$	<p>16. Write the number -0.06537995 in <i>scientific notation</i> the way it must be entered into a computer.</p>
664	<p>17. In the UNIX command <code>chmod _____ filename</code> what must be in the blank to set permissions to <code>rw-rw-r--</code> ?</p> <p>The structure of the question leads only to the absolute form of the <code>chmod</code> command. The code <code>rw-</code> corresponds to the bit pattern</p>

	110, which has octal value 6, used in both the “user” part and the “group” part. The code <code>r--</code> corresponds to the bit pattern 100, which has octal value 4, used in the “others” part.
<code>g-w</code>	18. In the UNIX command <code>chmod _____ filename</code> what must be in the blank to deny write permission to the group? The structure of the question leads only to the symbolic form of the <code>chmod</code> command. The group is <code>g</code> , to take away permission is <code>-</code> (minus), and write permission is <code>w</code> .
31	19. What is the decimal (base 10) value of the green component of the Web color <code>#F11FF1</code> ? The six characters of the color code use two characters (<code>F1</code>) for red, two characters (<code>1F</code>) for green, and two characters (<code>F1</code>) for blue. The decimal value of the green channel is $1 \times 16^1 + F \times 16^0 = 1 \times 16 + 15 \times 1 = 16 + 15 = 31$.
Magenta	20. What is the approximate color shown on screen for the Web color defined in problem 19? The red and blue channels are very high (they both start with <code>F</code>), but the green channel is very low (it starts with <code>1</code>). High red and high blue, but low green, is magenta, purple, fuchsia, lavender, etc.

<2> 8 Points – Trace the following gate circuit and show its output for all combinations of input values.



UNIX, FTP, and Web Design

<3> 3 Points – Short Answer – When you use PuTTY on a PC (in ssh mode) or use ssh on a Mac (in the Terminal program) to connect to the `el srv3` server, where are the UNIX commands you type (such as `mkdir`, `chmod`, `cd`, `emacs`, etc.) actually being performed? What is happening here? Do I have to be at UMass in order to use the `el srv3` server? Explain your answer.

1. The UNIX commands are being executed on the remote server, not on the local PC or Mac. (FYI: modern Macs do run UNIX in the Terminal program, but once connected through ssh to the remote server, any commands you type go directly to the server).
2. We are using the PC/Mac as a means of connecting to the server.
3. We can be anywhere connected to the Internet, not just at UMass.

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- <4> 5 Points – In the following URL, identify the protocol, the file path, the filename, the username, and the site address:

`http://www.cs.umass.edu/~verts/coins105/fall2009/Quiz1Answers.pdf`

Protocol: `http://`

File Path: `coins105/fall2009`

File Name: `Quiz1Answers.pdf`

User Name: `~verts`

Site Address: `www.cs.umass.edu`

- <5> 3 Points – Short Answer – Explain the differences between using **ftp** from the UNIX command line and a graphical program such as WinSCP on the PC or Fugu on the Mac. How easy is each approach? When you “fetch” a file, where does it end up in each case?

UNIX ftp is all command driven (users must type commands), which is difficult because users must remember both commands to type and where they take you on the site when a command is typed. Fetched files go to the UNIX folder from which ftp was started.

Graphical ftp is much easier to use than UNIX ftp because all options are on-screen or in menus, and users can see where they are on both local and remote systems. Fetched files go to the local PC/Mac where the graphical ftp program is running.

<6> 10 Points – Write an HTML code *fragment* (not a complete Web page) that implements a table, with a border, containing two rows and one column. The top cell contains the bold text **Flash Drives**, and the bottom cell contains the image file **Flash Drives.jpg** (notice the space in the file name) which links to the local Web page **Flash_Drives.html** (notice the underscore in the file name) when I click on the picture. The picture is larger than what shown in the Web page; the HTML must resize the image to exactly 250 pixels wide. Use only the minimum amount of HTML necessary to do the job; points will be removed for unnecessary code. The expected result is shown to the right.



```
<TABLE BORDER>                                -or-                                <TABLE BORDER="1">
  <TR>
    <TD>
      <B>Flash Drives</B>
    </TD>
  </TR>
  <TR>
    <TD>
      <A HREF="Flash_Drives.html">
        <IMG SRC="Flash%20Drives.jpg" WIDTH="250">
      </A>
    </TD>
  </TR>
</TABLE>
```

<7> 5 Points – Which file types (.BMP, .GIF, .JPG, .PNG) would I use for the following kinds of pictures to go on a Web page? List all correct types if more than one applies.

1. A photograph of a person in front of a mountain, containing thousands of colors.
.JPG or .PNG (both formats support millions of colors using lossy compression)
2. An animated cartoon of a frog sticking its tongue out.
.GIF (the only one of the three that supports animation)
3. A diagram containing black text and lines on a white background.
.GIF or .PNG (both formats support lossless compression)

Note: while .BMP files are supported by Web browsers (now, anyway, they didn't use to be), the files are so large that it is not practical to use them. The use of .BMP files is greatly discouraged.

<8> 8 Points – Short Answer – I have on my PC an 1000×1000 pixel image called **big_pic.jpg** and a 50×50 pixel image called **thumbnail.jpg**. Both contain the same picture, but at different resolutions. I want to build a Web page which contains a small image that links to the equivalent big image, and I've thought of two separate approaches which *appear on screen* to be identical. What are the relative advantages of each approach shown below?

1.

```
<A HREF="big_pic.jpg">  
    <IMG SRC="big_pic.jpg" WIDTH="50" HEIGHT="50">  
</A>
```
2.

```
<A HREF="big_pic.jpg">  
    <IMG SRC="thumbnail.jpg">  
</A>
```

Advantages of approach 1 over approach 2:

There is only one image file to manage in the site, rather than two.

Once downloaded for the 50×50 view (which will be slow due to the download of the massive file), showing the full version will be fast because the big image is already in the cache. (I don't expect this answer to appear very often.)

Advantages of approach 2 over approach 1:

Downloading the thumbnail is very fast.

The user is not forced to download the large image unless it is desired.

BÉZIER CURVES

<9> 3 Points – Short Answer – The curve tool in Windows Paint is really a Bézier curve. If I join two Bézier curves end-to-end but the common end points and their corresponding control points are not all in a straight line, do the curves blend smoothly one into the other? Why or why not?

No, they do not blend smoothly. A Bézier curve is tangent to its control lines (the lines between the end points and their corresponding control points) at each end point; for two Bézier curves to meet at a common end point and blend smoothly the control lines must be the same. If the three points are not in a straight line, each Bézier curve is tangent to a different line, forming a sharp break (discontinuity) at the place where the two curves join.

WORD PROCESSING

<10> 5 Points – Examine the picture of the sign to the right for the following questions.

1. Does the typeface in the sign have serifs, or is it sans-serif?

Sans-serif. The letters have no decorative marks at the edges and corners.

2. The letters on the top two lines are each around 3 inches high. How many points is that?

3 inches \times 72 points per inch = 216 points.

3. On the picture, indicate (circle) all the places where kerning has been applied.

The places are the **WA** and **AT** in **WATER** on the top line, the **LV** and **VA** in **SALVA** on the middle line, and the **AT** in **REGULATIONS** in smaller type on the bottom line.



<11> 5 Points – Short Answer – In Microsoft Word I change the definitions (font, indents, line spacing, paragraph justification, etc.) of one of the named *styles* used frequently throughout my document. What happens as soon as I finish making those changes?

All paragraphs throughout the document with that style automatically update to the new appearance.

<12> 5 Points – Short Answer – Why is it a good idea to know where the **Normal.dot** (Word 2003 or earlier) or **Normal.dotm** file (Word 2007 or Word 2008 for the Mac) is stored?

Any of the following answers are acceptable:

1. If the **Normal** file gets corrupted, you can delete it and Word will regenerate a default version.
2. You can keep a backup copy to restore manually if the **Normal** file becomes corrupted (this is particularly important if you have defined new styles).
3. You can create an identical environment (all your defined styles) on a new machine by copying the **Normal** file from one machine to another, instead of rebuilding styles from scratch.

SPREADSHEETS

- <13> 5 Points – Cell **x99** contains the following formula which is then copied to cell **AB104**. What is the resulting formula in cell **AB104** after the copy has been completed?

=W100+\$AA98+AB95*50-AC110+Z99

=AA105+\$AA103+AF100*50-AG115+AD104

The formula is being shifted to the right by 4 columns and down by 5 rows. All relative addresses get shifted by the same amount:

W100: W + 4 = AA, 100 + 5 = 105

\$AA98: \$AA stays unchanged, 98 + 5 = 103

AB95: AB + 4 = AF, 95 + 5 = 100

50: This is not a cell address and is not changed!

AC110: AC + 4 = AG, 110 + 5 = 115

Z99: Z + 4 = AD, 99 + 5 = 104

- <14> 4 Points – The cursor is in some cell in Sheet1. Write the *shortest possible* Excel formula to add up cells **A1, A2, A3, A4, B1, B2, B3, B4, C1, and C2**, which are all located in Sheet2.

=SUM(Sheet2!A1:B4, Sheet2!C1:C2)

=SUM(Sheet2!A1:C2, Sheet2!A3:B4)

The block has the following shape:

	<u>A</u>	<u>B</u>	<u>C</u>
1:	x	x	x
2:	x	x	x
3:	x	x	
4:	x	x	

This shape cannot be performed with a single range, but can be done with two ranges in two different ways (either the pair **A1:B4** and **C1:C2** or the pair **A1:C2** and **A3:B4**). As each range is from a sheet (**Sheet2**) other than the one the formula is in (**Sheet1**), the page name has to be appended to each range. All the ranges form the arguments to a single **SUM** function.

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<15> 6 Points – Here is a spreadsheet containing numeric data representing two complex numbers. Each complex number requires two separate cells (**N1** is the complex number **5-3i**, with the real part stored in cell **C4** and the imaginary part stored in **D4**, and **N2** is the complex number **-4+7i**, correspondingly stored in cells **C5** and **D5**).

	A	B	C	D
1				
2			Complex Numbers	
3			Real Part	Imaginary Part
4		N1	5	-3
5		N2	-4	7
6				
7		N1+N2		
8		N1*N2		
9				

1. (2 points) Write formulae for cells **C7** and **D7** to compute the complex sum of **N1** and **N2** (i.e., **N1 + N2**).

C7: **=C4+C5** *-or-* **=SUM(C4:C5)**

D7: **=D4+D5** *-or-* **=SUM(D4:D5)**

2. (4 points) Write formulae for cells **C8** and **D8** to compute the complex difference of **N1** and **N2** (i.e., **N1 - N2**).

C7: **=C4-C5** One point removed for using the SUM function.

D7: **=D4-D5** One point removed for using the SUM function.

<16> 5 Points – Completely parenthesize the following expression to show exactly how it will be evaluated in Excel:

$$= 9 - 4 ^ 8 + 5 * 6 / 2 ^ 7$$

After handling the exponentiation operators:

$$= 9 - (4 ^ 8) + 5 * 6 / (2 ^ 7)$$

After handling the multiplication and division operators:

$$= 9 - (4 ^ 8) + ((5 * 6) / (2 ^ 7))$$

After handling the addition and subtraction operators (final answer):

$$= ((9 - (4 ^ 8)) + ((5 * 6) / (2 ^ 7)))$$