Midterm

Please read all the problems carefully. Do everything we ask for, neither more nor less. If you have any questions on what a problem means, don’t hesitate to ask. There are 64 points possible. Don’t get bogged down on any one problem; if you have trouble on a problem, go on to the next one.

You may not share any information or materials with classmates during the exam and you may not use any electronic devices.

Use the correct terminology wherever possible in your answers.

Please write your answers clearly and neatly—we can’t give you credit if we can’t decipher what you’ve written. Use the backs of the pages (or any other paper) for scratch work, but cross out any work that you don’t want us to consider as part of your answer (and if your answer doesn’t appear entirely within the indicated answer space for a question, indicate clearly where the rest of the answer is).

We’ll give partial credit for partially correct answers, so writing something is better than writing nothing. But we will also deduct for irrelevant, extraneous information, even if the correct answer is buried somewhere within it, so don’t just write down everything you know. We have given length guidelines for many answers; ignore them at your own risk (but aim for clarity and conciseness more than a specific number of sentences in your answer). Unless your handwriting is huge, the space we provide for an answer should be more than enough. It is generally best to think more and write less.

Good luck!

Problem 1 (3 points) Simple terminology matching

a. assembler
b. compiler
c. program counter
d. source code
e. open source
f. terabyte (TB)
g. gigabyte (GB)
h. megabyte (MB)
i. kilobyte (KB)
j. byte
k. URL
l. HTTP
m. HTML
n. register
o. high-level prog. lang.

Match a term to each phrase below. **SCORING: 1/2 point each.**

___ for example, Python or C++ or Snap (o.high-level PL)
___ about 1000 megabytes (g.gigabyte)
___ enough space to store one keystroke (or two decimal digits in Deus X) (j.byte)
___ language of source code for web pages (that a browser interprets) (m.HTML)
___ special storage location in CPU with circuitry for arithmetic and comparisons (n.reg)
___ software that translates assembly language programs into object code (ML) (a.asmblr)
Problem 2 (8 points)  **Internet organization and operation**

Suppose you type www.IreallyreallyloveICS10.com into your web browser and you get a “Page not available” message. The source of the problem could be any of these:

A. your computer’s hardware or software
B. the network connection from your computer to your ISP
C. your ISP’s system
D. the internet “backbone” and internet traffic routing
E. the server www.IreallyreallyloveICS10.com

So you gather additional information. Each set of facts listed below eliminates some of the above sources as likely causes of the problem. For each set of facts, list one or more sources (chosen from A through E) that is probably eliminated, given those facts. Consider each set of facts ((a) through (d)) separately and independently from the other fact sets.

<table>
<thead>
<tr>
<th>Fact set: (SCORING: — 1/2 for each incorrect letter—incorrectly included or incorrectly omitted. E.g., correct=ABC, response=BCD: —1/2 for no A, —1/2 for having D, total —1)</th>
<th>Sources (from A–E) now less likely:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: The person sitting next to you types the same URL on her computer and sees the contents of the web page <a href="http://www.IreallyreallyloveICS10.com">www.IreallyreallyloveICS10.com</a></td>
<td>C, D, E</td>
</tr>
<tr>
<td>(a) You call a friend in New York and another in Paris. They enter the URL and see the contents of the web page <a href="http://www.IreallyreallyloveICS10.com">www.IreallyreallyloveICS10.com</a></td>
<td>D, E</td>
</tr>
<tr>
<td>(b) You call a friend in New York and another in Paris. They enter the URL and get the same message you got.</td>
<td>A, B, C</td>
</tr>
<tr>
<td>(c) The person sitting next to you types the same URL on her computer and gets the same message you got.</td>
<td>A, B</td>
</tr>
<tr>
<td>(d) You call a friend in New York and another in Paris. They enter the URL and get the same message. They can reach other URLs without trouble.</td>
<td>A, B, C, D</td>
</tr>
</tbody>
</table>

Problem 3 (12 points)  **SNAP flow of control**

For each block of SNAP code below, write down, in order, everything that it “says” when you run it.

Example:

![SNAP code image]

Answer: 

```
Hello!
Good-bye!
We’re done now.
```
(a) (2 points)

(b) (3 points)

(c) (3 points)

(d) (4 points)
Problem 4 (13 points) Snap Blocks and Parameters

(a) (4 points) What does the following Snap code “say” when clicked?

(b) Now suppose we define a block to do this task, with a parameter:

(b.1) (2 points) One block (one line) inside the definition must be deleted for this code toward properly. What is it? (You can just cross it out on the picture.)

The “Set start to 5” line. The parameter does that automatically.

(b.2) (7 points) After making the change, what does the following code “say”?

2 ..... 
1 ..... 
Blastoff! 
Again 
3 ..... 
2 ..... 
1 ..... 
Blastoff!
Problem 5 (11 points) Deus X

Below is a Deus X program, shown loaded into memory. (An assembly language version is also shown, but you can answer the question by reading just the machine language itself.) The registers and comparison indicators also appear, to help you as your work. A copy of the Deus X instruction set is provided with the exam.

<table>
<thead>
<tr>
<th>Address</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.</td>
<td>[40</td>
</tr>
<tr>
<td>1.</td>
<td>[5</td>
</tr>
<tr>
<td>2.</td>
<td>[5</td>
</tr>
<tr>
<td>4.</td>
<td>[51</td>
</tr>
<tr>
<td>5.</td>
<td>[60</td>
</tr>
<tr>
<td>6.</td>
<td>[51</td>
</tr>
<tr>
<td>7.</td>
<td>[61</td>
</tr>
<tr>
<td>8.</td>
<td>[30</td>
</tr>
<tr>
<td>9.</td>
<td>[7</td>
</tr>
<tr>
<td>10.</td>
<td>[20</td>
</tr>
<tr>
<td>11.</td>
<td>[6</td>
</tr>
<tr>
<td>12.</td>
<td>[8</td>
</tr>
<tr>
<td>13.</td>
<td>[X X X X]signal:</td>
</tr>
<tr>
<td>14.</td>
<td>[ ]word2check:</td>
</tr>
<tr>
<td>15.</td>
<td>[ ]inputline:</td>
</tr>
<tr>
<td>. . .</td>
<td>[ ]</td>
</tr>
<tr>
<td>35.</td>
<td>[ ]count:</td>
</tr>
<tr>
<td>. . .</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

The input consists of 9 lines in a file, as shown below.

```
blue
red
pink
blue
blue
red
blue
pink
XXXX
```

(a) (2 points) Given the input data shown, what does this program print out?

3. Just the number.
(b) (2 points) In one brief English sentence, describe how this program “knows” when to stop. Don’t just say that it stops when it executes the Halt instruction; describe how it gets to the end in terms of what data it reads.

**It stops when it reads a line (starting with) XXXX.**

(c) (3 points) In one brief English sentence, describe what task this program performs. Don’t just describe the operations one by one; give a sentence we could use in an “app store” so that prospective buyers can decide whether it meets their needs.

**It counts the number of times a specified word occurs in the input.** [Full-credit answer needs idea of counting words or input lines, idea of counting just some of the lines, idea of matching lines against something (just “a specified word” is okay).] 2 points for “counts the number of times ‘blue’ occurs”

(d) (2 points) What would this program print if the first input line contained tan instead of blue?

0.

(e) (2 points) What would this program print if the first input line contained pink instead of blue?

2.

**Problem 6 (8 points) Deus X /CPU Behavior**

As we’ve noted in class, the machine language of any processor can do four kinds of instructions: arithmetic, copying data, comparing values, and choosing what to do next (perhaps based on the comparison).

(a) (2 points) List three Deus X op codes that perform arithmetic.

**Any three of: 1, 2, 3, 4, 30, 31 (mnemonic abbreviations also okay)**

(b) (2 points) List three Deus X op codes that copy data.

**Any three of: 5, 6, 9, 10, 20, 21, 40, 41 (mnemonic abbreviations also okay)**

(c) (2 points) List two Deus X op codes that perform comparisons.

**50 and 51 (CMPA and CMPB)**

(d) (2 points) List three Deus X op codes that transfer control (specify what to do next).

**Any three of: 7, 60, 61, 62, 63 (mnemonic abbreviations also okay)**
Problem 7 (9 points)

Multiple multiple choice questions—please choose all the answers that apply; more than one of the available choices may be correct (circle one or more of A, B, C, D, and/or E).

SCORING: 3 points poss., –1 for each wrong response (wrongly circled, wrongly omitted). Min is 0.

(a) Which of the following are design characteristics of the Internet? (Choose one or more of the following.)

A. It would be simpler if all internet traffic were handled by a single, centralized supercomputer, but we can't build one that's big enough and reliable enough to do the job. (THIS ONE)
B. With circuit-switching, all the data in a transaction between A and B follows the same route. (THIS)
C. The decentralized design of the Internet keeps the network as a whole reliable, even when some connected computers fail. (THIS)
D. Message transmission on the Internet is done using packet switching, with a single direct connection between each pair of computers.

(b) Which of the following is an accurate statement about methods of distributing software? (Choose one or more of the following.)

A. Conventional sale of the object code for an application keeps control of modifications in the developer's hands because the object code alone is nearly impossible to decipher and modify. THIS ONE
B. Conventional sale of object code requires continuous internet access to use the application.
C. Open-source software can be checked for accuracy by trusted independent experts, leading to greater confidence in the application’s correctness and reliability. THIS ONE
D. Cloud computing (“applications in the cloud”) place the least burden on the end user for keeping the software up to date. THIS ONE
E. Because open-source software includes the entire source code as well as the executable application, it is generally more expensive than software distributed by other means.

(c) Which of the following are accurate statements about programming languages and software development? (Choose one or more of the following.)

A. Some problems, even if clearly stated, can't be solved by information technology. (THIS ONE)
B. We can devise a correct algorithm to solve a problem, then code it up correctly in some programming language and run it, and still not get results we can use. (THIS ONE)
C. Coming up with an algorithm to solve a new problem isn’t usually as hard as coding that algorithm in some programming language (because programming is a complex activity).
D. These days, nearly any professional person needs to understand programming at least at the level of visual programming like Snap.