Practice final

4 May 2016

You have up to 1 hour, 45 minutes. You may use a calculator, but no text book or notes.

1. For each statement below, fill in the blank with the *best* term from the following list. Some terms might be used more than once; some might not be used at all.

   • HTML • HTTP • IP address • domain name • foreign key • frequency analysis • minimax • operating system • password • postfix • prefix • primary key • public key • table

   (a) ______________________ is the main language in which the structure and content of a web page is specified.

   (b) A(n) ______________________ is an attribute in a database table whose value references a record in a different table.

   (c) ______________________ is a notation for arithmetic in which the operator is written *after* the operands, such as `3 5 +`

   (d) ______________________ is a technique for trying to decrypt a message without requiring access to the shared secret. It's especially effective in a mono-alphabetic code.

   (e) A(n) ______________________ is a numeric identifier for each machine on the Internet. The current version is 32 bits.

2. Which of the following schemes is the more secure authentication mechanism?

   (a) A three-character password, using upper- and lower-case letters and digits.

   (b) A four-character password, using just lower-case letters.

   Explain why. Recall that we can quantify the security of a password using the number of *possible* passwords.

3. Explain how presenting a photo ID in the physical world is an example of *two-factor authentication.*

4. Evaluate the following *prefix* expression. What result does it produce?

```
(* (+ 3 5) (- 6 2))
```

5. Convert the prefix expression from the previous question into *postfix* notation.

6. Describe the main purpose of the Domain Name Service (DNS).

7. What is the output of the following Python program?

```
four = 4
six = four + 2
print("six is six")
six = six - 3
print(six+1)
four = four * four
print(four+4)
print("five * four")
```

8. What is the output of the following Python program?

```
xy = 5
zq = 3
print(xy*2)
if xy > 7:
    print("yes")
print(xy + zq)
print("xy")
```

9. The three tables below are a simplification of the database for a social networking web site, like Facebook. There is one main table, 'User', and two other tables that contain foreign keys to 'User'.

User:

ID*	Name	Birthday	Password hash
1	Alice Anwar	1974/08/18	cf6a52053ff904bca9d96fd4e7740d7d
2	Bob Björk	1989/11/07	75e22f4965738386cbe02bca10d3120d
3	Carl Carlson	1993/05/03	61aa5b6c78fa4e3636069347ae39df10
4	Denise Doe	1989/12/21	98246ef16a87c12407e5fada044f591e
5	Edward Eng	1990/11/19	1ca30cd59f0b566f9ef3a8208679585e
6	Francine Fuentes	1992/03/25	e5dbb7657f770fad038220f5c69d806c

Friendship — indicates which users are friends with which other users:

User 1 ↑	User 2 ↑	Status	Date
1	2	approved	2014/12/10
1	4	approved	2014/03/24
1	5	approved	2015/05/06
2	3	approved	2015/11/01
2	4	approved	2015/08/03
3	4	approved	2014/09/04
3	5	requested	2014/08/04
4	6	approved	2014/03/08

Wall Messages — sent between users:

Sender↑	Receiver↑	Date/time	Message
1	2	2016/04/05 11:51	"Hey man!"
1	5	2016/04/05 16:40	"What r u doing tonite?"
2	1	2016/04/05 17:45	"Send me some tunez"
2	3	2016/04/05 21:18	"Love that pic, LOL"
4	2	2016/04/05 23:00	"This prof is trying my patience."
3	1	2016/04/06 00:05	"Ugh, tired"
2	4	2016/04/06 06:37	"You rock!"

(a) Which user is the youngest? ______________________

(b) Which user has the most friends? ______________________

(c) The oldest friendship in the database is between which two users? ______________________ ______________________

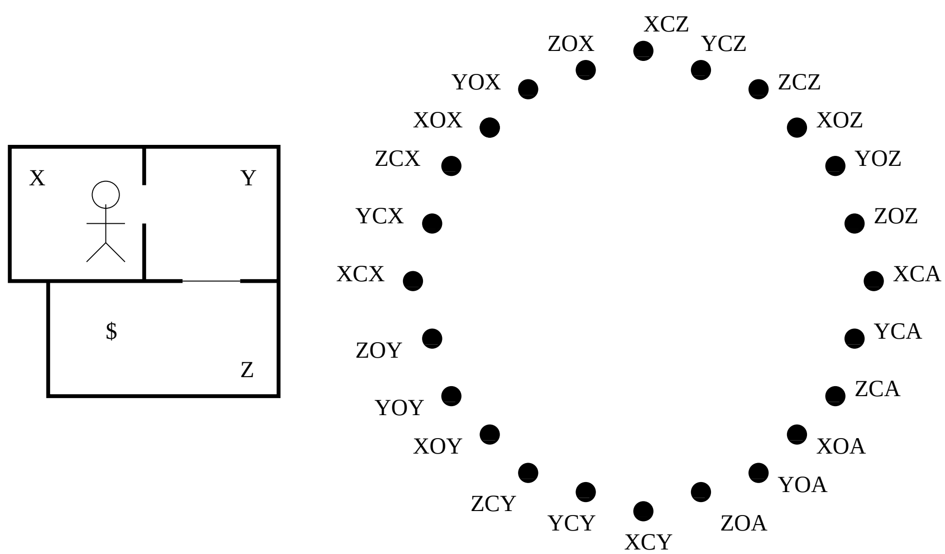
(d) Name all the friends of Bob Björk.

(e) Are there any wall messages between users who are *not* friends? Which ones?

10. This question is about planning using graph search in AI. Imagine a castle with 3 rooms, called X, Y, and Z. An adventurer starts in room X, and there is a treasure in room Z. Between rooms Y and Z is a closed (but not locked) door. See the map in the left side of the figure below. We can represent the entire state of this world using just three letters:

- the room containing the adventurer (X, Y, or Z);
- the status of the door (O for open, or C for closed); and
- the room containing the treasure (X, Y, Z, or A if the adventurer is carrying it).

That produces a total of 24 states ($3 \times 2 \times 4$). There are eight possible actions: north / south / east / west / open door / close door / take treasure / drop treasure. Of course, not all actions are possible from all states. From the start state, `XCZ`, the only possible action is **east,** which puts us in state `YCZ`.



The right side of the diagram above depicts all 24 states, arrange in a circle so it is easy to draw lines between any two states.

(a) In your own words, describe the meaning of the state `ZCY`.

(b) Using the graph above, trace a complete path from the start state `XCZ` to the goal state `XOX`. (This corresponds to fetching the treasure, carrying it back to room X, and dropping it there.)

(c) How many states would there be if we added another room, *W*, to the west of X?

11. In an attempt to conceal the character frequencies that are the downfall of a monoalphabetic substitution, the Vigenère technique (1553) switches the alphabet used on each letter, according to a secret keyword. We start with a table of shifted alphabets:

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
a	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
b	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a
c	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b
d	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c
e	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d
f	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e
g	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f
h	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g
i	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h
j	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i
k	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j
l	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k
m	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l
n	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m
o	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n
p	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
q	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
r	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q
s	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
t	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s
u	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t
v	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
w	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v
x	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w
y	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x
z	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y

Below is a secret message encoded with the keyword ‘blimp‘. Work backwards to discover the message. The result should be two actual English words.

message:								
key:	b	l	i	m	p	b	l	i
encrypted:	h	l	u	q	d	w	p	z