

Practice final solutions

3 May 2017

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.

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

- (a) HTML is the main language in which the structure and content of a web page is specified.
- (b) A(n) foreign key is an attribute in a database table whose value references a record in a different table.
- (c) postfix is a notation for arithmetic in which the operator is written *after* the operands, such as $3\ 5\ +$
- (d) frequency analysis 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) IP address 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.

Password scheme (a) has 62 possibilities for each character (26 upper plus 26 lower plus 10 digits). There are three characters, so $62^3 = 238,328$ possible passwords. Password scheme (b) has 26 possibilities for each character, and there are four characters so $26^4 = 456,976$ possible passwords. That means that (b) is the more secure scheme, which may be counter-intuitive. (Of course, they're both pretty bad.)

3. Explain how withdrawing cash from an ATM employs *two-factor authentication*.

The authentication categories are:

- Something you **know**
- Something you **have**
- Biometric

In an ATM transaction, you present something you **have** (the bank card) and then something you **know** (the PIN).

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

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

$\Rightarrow (* 8 (- 6 2))$

$\Rightarrow (* 8 4)$

$\Rightarrow 32$

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

$3 5 + 6 2 - *$

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

DNS translates a domain name (a text identifier, like `google.com`) into an IP address (like `124.18.38.3`).

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")
```

```
six is six
4
20
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")
```

```
10
8
xy
```


10. 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	i
encrypted:	h	l	u	q	d	w	z

The message is "gameover"