

Assignment 4

1. The American author Edgar Allen Poe (1809 – 1849) used a cipher for his story *The Gold Bug*. An excerpt from it is shown here.

) 4 ‡ ‡ ; 1 (‡ 9 ; 4 8 0 8 1 ; 8 : 8 ‡ 1 ; 4 8 † 8 5 ; 4) 4 8 5 † 5 2 8 8 0
6 * 8 1 (‡ 9 ; 4 8 ; (8 8 ; 4 (‡ ? 3 4 ; 4 8) 4 ‡ ; 1 6 1 ; : 1 8 8 ; ‡ ? ;

- a) The cipher is a simple substitution cipher. The symbol that occurs the most number of times in the cipher is 8. What letter of the alphabet is 8 most likely to stand for?
- b) What common three-letter word ending with this letter might occur more than once in the cipher?
- c) What set of three characters in the cipher might stand for this word?
- d) Another word deciphered near the beginning in Poe's story is represented by the symbols
; (8 8

What do you think the word is?

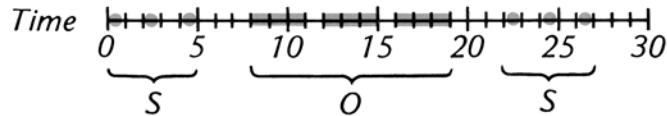
2. Visit <http://www.civilwarsignals.org/cipher/pigpencipher.html> to learn about the *pigpen cipher* which was used by Freemasons in the 18th Century to keep their records private.

- a) Use the information in the web page to decrypt or decipher the following message:

>N> Γ∨ ULEJLW JOM OM >N>OM JOM
ΓEM∨ JFE<OM OM JFE<OM?
J ΓOMΓ<ΓOM ΓOM J FOM^EEL^ΓOM ΓEEM.

- b) Enter a brief message (minimum 20 characters / maximum 30 characters) into the applet in the web page, then copy both the “plain text” and “cipher text” below.

3. A well-known signal of distress is **••• — — — •••**, which is Morse code for the letters S O S. In the transmission of Morse code, each dash takes three times as long as each dot. The figure below shows the relative amounts of time for each part of the SOS signal. To send an S takes 5 units of time and to send an O takes 11 units.



The table below shows the Morse code symbol for each letter of the alphabet.

<i>Letter</i>	<i>Symbol</i>	<i>Letter</i>	<i>Symbol</i>
A	•••••	N	•••••
B	••••••••••	O	••••••••••
C	••••••••••	P	••••••••••
D	•••••••	Q	••••••••••
E	•	R	•••••••
F	••••••••••	S	•••••
G	••••••••••	T	••••
H	•••••••	U	•••••••
I	•••	V	••••••••••
J	••••••••••	W	••••••••••
K	••••••••••	X	••••••••••
L	••••••••••	Y	••••••••••
M	•••••••	Z	••••••••••

- Which letter takes just 1 unit of time to send?
- Which letters take 3 units of time to send?
- Which letters take 5 units of time to send?

Refer to the table of the frequencies of the letters in ordinary English on page 62:

- What do you notice about the frequencies of the letters that you named in exercises a) through c)?
- Which letters take the longest time (13 units) to send?
- What do the frequencies of these letters have in common?
- Which letters take 11 units of time to send?
- The symbol for one of these letters seems like a very poor choice. Which letter and why?

- This is a highly unusual paragraph. Do you know why? If you try to find out what is odd about it too quickly, it probably won't occur to you. Study it without hurrying and you may think of what it is. Good luck.
- Make a cipher-wheel as provided and described on the accompanying handout, then go through the example therein to learn how to use it.

When done, decrypt or decipher this message, with the key-number 1066:
 [Be efficient – Do all the letters for a specific number at the same time!]

HBNBX PDFHB RSVVO TIQYB YVTTM WTXNG WLIQF

NHCBM EBZXI IBSHQ YBHSB BIBSD PBSBX

– Alexander Pope (1688-1744)

- Which of the following is the correct UPC for Franco-American SpaghettiOs with Meatballs? Show why the other numbers are not valid UPCs.

0 5 1 0 0 0 0 2 5 6 2 5

0 5 1 0 0 0 0 2 5 2 6 4

0 5 1 0 0 0 0 2 5 2 6 5

- Find the missing digit in the UPC for Gerber First Foods Applesauce. Show all work.

0 1 5 0 0 0 0 7 1 3 1 ____

8. Find the missing digit in the UPC for Celis Ale Grand Cru. Show all work.

___ 3 5 8 8 8 4 1 2 0 1 9

9. Determine the check digit for the following bank code. Show all work.

5 5 0 3 1 0 1 1 ___

10. Find the check digit for the following ISBN. Show all work. *See page 72.*

1 - 9 3 1 - 9 1 4 4 1 - ___

11. An airline ticket identification number is a 14-digit number. The check digit is the remainder when the identification number is divided by 7 or a number between 0 and 6 that represents what the identification number is equivalent to using a mod 7 clock. What is the check digit for the airline ticket identification number 1 006 1559129884?

A 14-digit number can be very difficult to divide by seven. Most calculators don't hold that many digits. Also, they normally return remainders as decimal parts of the dividend, not as the whole number we are seeking. Access the Mod P Calculator applet in http://britton.disted.camosun.bc.ca/modP_calculator/CalculatorApplet.html.

To use the applet:

- Enter the divisor or mod by pressing the 7 button and then set P.
- Enter the dividend by pressing the digits of 10061559129884 in order and then =.
- The equivalent (remainder) mod 7 will appear on the applet screen.
- Print the page as proof of your use, then attach the printout to this assignment.

12. A simple check digit process is used for Canadian Social Insurance Numbers (SIN). Visit http://en.wikipedia.org/wiki/Social_Insurance_Number for details.

a) Show that 218 607 284 is an invalid SIN.

b) Verify that your own SIN (or that of another Canadian) is valid.