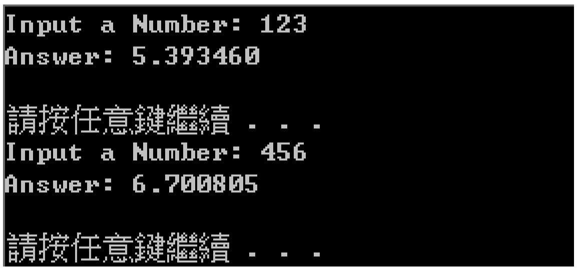
Introduction to Computers and Programming LAB-7 2014/11/05

- ✧ Your output must be in our sample output format.
- ✧ In **Problem 1~5**, please wrap each of your code inside main(){} with while(1){}, which is shown in Problem 1.

1. Write a program to computing the value of

   $1 + {}^{1}/_{1} + {}^{1}/_{2} + {}^{1}/_{3} + \cdots + {}^{1}/_{n}$ where n is an integer entered by user.

```
#include<stdio.h>
#include<stdlib.h>

int main(void)
{
        while(1)
        {
              int i, n;
              float ans = 0;
              printf("Input a Number: ");
              scanf("%d", &n);
              for(i=1; i<=n; i++)
              {
                      // write something
              }
              printf("Answer: %f\n\n", ans);
              system("pause");
        }
        return 0;
}
```



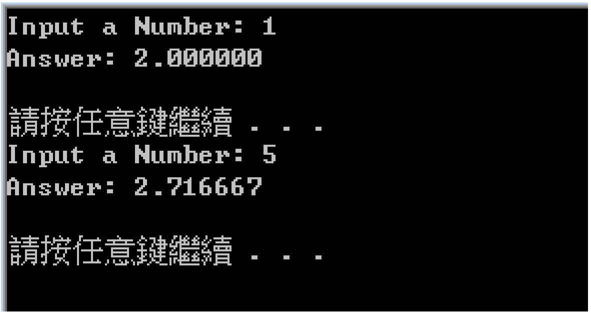
```
Input a Number: 123
Answer: 5.393460

請按任意鍵繼續 . . .
Input a Number: 456
Answer: 6.700805

請按任意鍵繼續 . . .
```

2. The value of the mathematical constant e can be expressed as an infinite series:

   $e = 1 + {}^{1}/_{1!} + {}^{1}/_{2!} + {}^{1}/_{3!} + \cdots$

   Write a program that approximates e by computing the value of

   $1 + {}^{1}/_{1!} + {}^{1}/_{2!} + {}^{1}/_{3!} + \cdots + {}^{1}/_{n!}$ where n is an integer entered by the user.



```
Input a Number: 1
Answer: 2.000000

請按任意鍵繼續 . . .
Input a Number: 5
Answer: 2.716667

請按任意鍵繼續 . . .
```

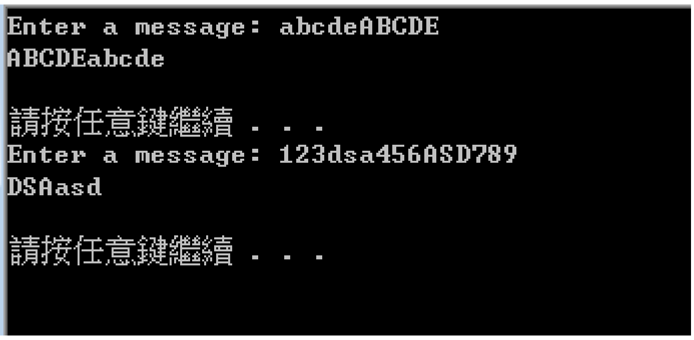
3. Capital letter and small letter

   Write a program to convert input message by the following rule:

   (1) If the input character is a capital letter, you should change it to small letter and output it.

   (2) If the input character is a small letter, you should change it to capital letter and output it

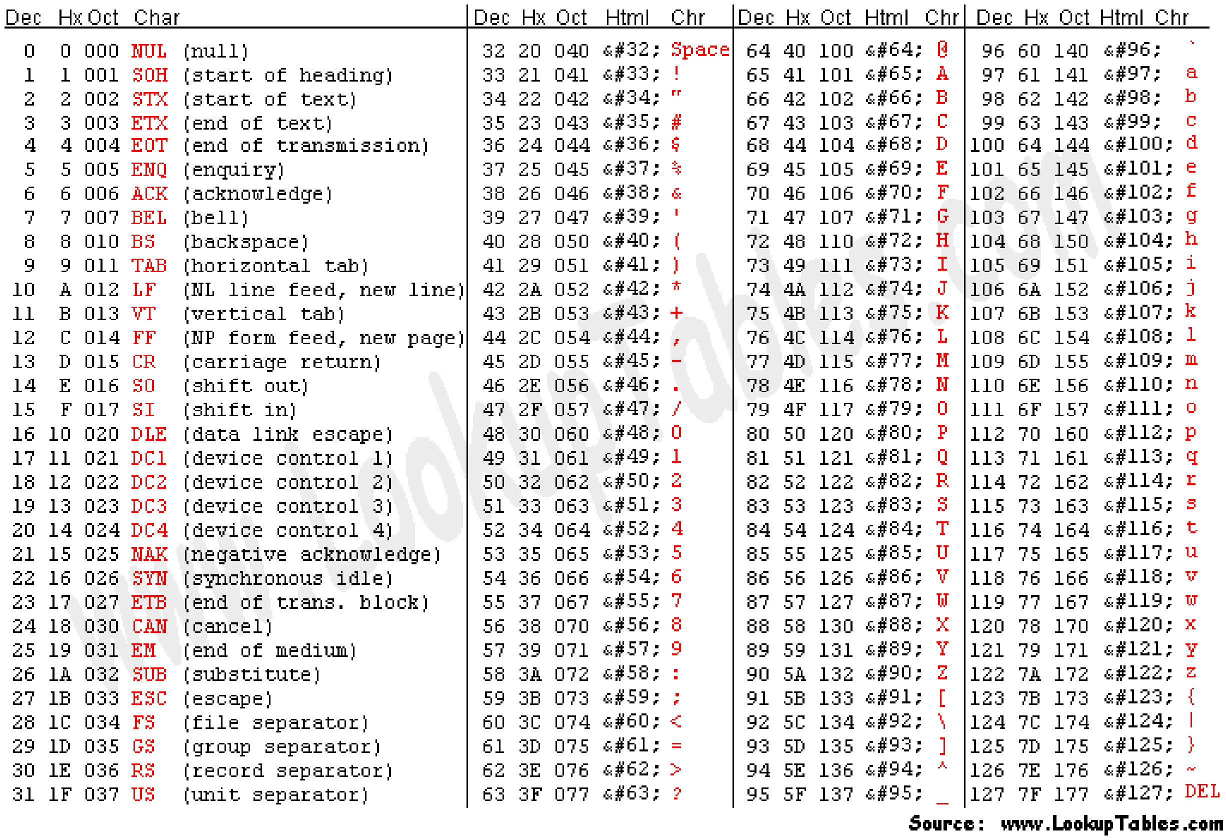
   (3) If the input character is not a letter, you should ignore it.



```
Enter a message: abcdeABCDE
ABCDEabcde

請按任意鍵繼續 . . .
Enter a message: 123dsa456ASD789
DSAasd

請按任意鍵繼續 . . .
```

Hint: ASCII code table (notice the Dec range of A~Z and a~z)

ASCII code table

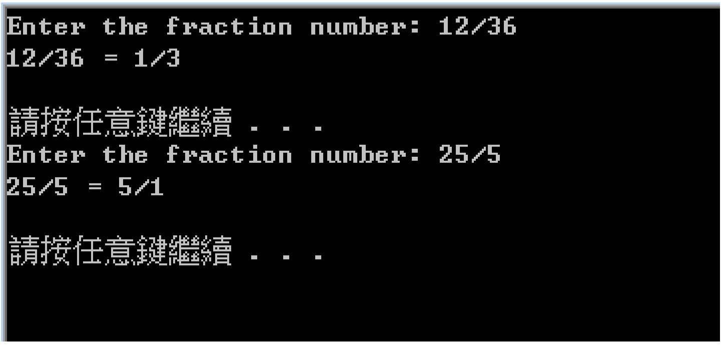


Dec	Hx	Oct	Char		Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL	(null)	32	20	040	&#32;	Space	64	40	100	&#64;	@	96	60	140	&#96;	`
1	1	001	SOH	(start of heading)	33	21	041	&#33;	!	65	41	101	&#65;	A	97	61	141	&#97;	a
2	2	002	STX	(start of text)	34	22	042	&#34;	"	66	42	102	&#66;	B	98	62	142	&#98;	b
3	3	003	ETX	(end of text)	35	23	043	&#35;	#	67	43	103	&#67;	C	99	63	143	&#99;	c
4	4	004	EOT	(end of transmission)	36	24	044	&#36;	$	68	44	104	&#68;	D	100	64	144	&#100;	d
5	5	005	ENQ	(enquiry)	37	25	045	&#37;	%	69	45	105	&#69;	E	101	65	145	&#101;	e
6	6	006	ACK	(acknowledge)	38	26	046	&#38;	&	70	46	106	&#70;	F	102	66	146	&#102;	f
7	7	007	BEL	(bell)	39	27	047	&#39;	'	71	47	107	&#71;	G	103	67	147	&#103;	g
8	8	010	BS	(backspace)	40	28	050	&#40;	(	72	48	110	&#72;	H	104	68	150	&#104;	h
9	9	011	TAB	(horizontal tab)	41	29	051	&#41;	)	73	49	111	&#73;	I	105	69	151	&#105;	i
10	A	012	LF	(NL line feed, new line)	42	2A	052	&#42;	*	74	4A	112	&#74;	J	106	6A	152	&#106;	j
11	B	013	VT	(vertical tab)	43	2B	053	&#43;	+	75	4B	113	&#75;	K	107	6B	153	&#107;	k
12	C	014	FF	(NP form feed, new page)	44	2C	054	&#44;	,	76	4C	114	&#76;	L	108	6C	154	&#108;	l
13	D	015	CR	(carriage return)	45	2D	055	&#45;	-	77	4D	115	&#77;	M	109	6D	155	&#109;	m
14	E	016	SO	(shift out)	46	2E	056	&#46;	.	78	4E	116	&#78;	N	110	6E	156	&#110;	n
15	F	017	SI	(shift in)	47	2F	057	&#47;	/	79	4F	117	&#79;	O	111	6F	157	&#111;	o
16	10	020	DLE	(data link escape)	48	30	060	&#48;	0	80	50	120	&#80;	P	112	70	160	&#112;	p
17	11	021	DC1	(device control 1)	49	31	061	&#49;	1	81	51	121	&#81;	Q	113	71	161	&#113;	q
18	12	022	DC2	(device control 2)	50	32	062	&#50;	2	82	52	122	&#82;	R	114	72	162	&#114;	r
19	13	023	DC3	(device control 3)	51	33	063	&#51;	3	83	53	123	&#83;	S	115	73	163	&#115;	s
20	14	024	DC4	(device control 4)	52	34	064	&#52;	4	84	54	124	&#84;	T	116	74	164	&#116;	t
21	15	025	NAK	(negative acknowledge)	53	35	065	&#53;	5	85	55	125	&#85;	U	117	75	165	&#117;	u
22	16	026	SYN	(synchronous idle)	54	36	066	&#54;	6	86	56	126	&#86;	V	118	76	166	&#118;	v
23	17	027	ETB	(end of trans. block)	55	37	067	&#55;	7	87	57	127	&#87;	W	119	77	167	&#119;	w
24	18	030	CAN	(cancel)	56	38	070	&#56;	8	88	58	130	&#88;	X	120	78	170	&#120;	x
25	19	031	EM	(end of medium)	57	39	071	&#57;	9	89	59	131	&#89;	Y	121	79	171	&#121;	y
26	1A	032	SUB	(substitute)	58	3A	072	&#58;	:	90	5A	132	&#90;	Z	122	7A	172	&#122;	z
27	1B	033	ESC	(escape)	59	3B	073	&#59;	;	91	5B	133	&#91;	[	123	7B	173	&#123;	{
28	1C	034	FS	(file separator)	60	3C	074	&#60;	<	92	5C	134	&#92;	\	124	7C	174	&#124;	|
29	1D	035	GS	(group separator)	61	3D	075	&#61;	=	93	5D	135	&#93;	]	125	7D	175	&#125;	}
30	1E	036	RS	(record separator)	62	3E	076	&#62;	>	94	5E	136	&#94;	^	126	7E	176	&#126;	~
31	1F	037	US	(unit separator)	63	3F	077	&#63;	?	95	5F	137	&#95;	_	127	7F	177	&#127;	DEL

Source: www.LookupTables.com

4. Write a program that's asks the user to enter a fraction, then reduces the fraction to lowest terms.

   Hint: To reduce a fraction to lowest terms, first compute the GCD of the numerator and denominator. Then divide both the numerator and denominator by the GCD. (GCD = greatest common divisor)



```
Enter the fraction number: 12/36
12/36 = 1/3

請按任意鍵繼續 . . .
Enter the fraction number: 25/5
25/5 = 5/1

請按任意鍵繼續 . . .
```

5. (Bonus) The 3n + 1 problem

Consider the following algorithm:

```
1.    input n
2.    print n
3.    if n = 1 then STOP
4.        if n is odd then    $n \longleftarrow 3n+1$
5.        else    $n \longleftarrow n/2$
6.    GOTO 2
```

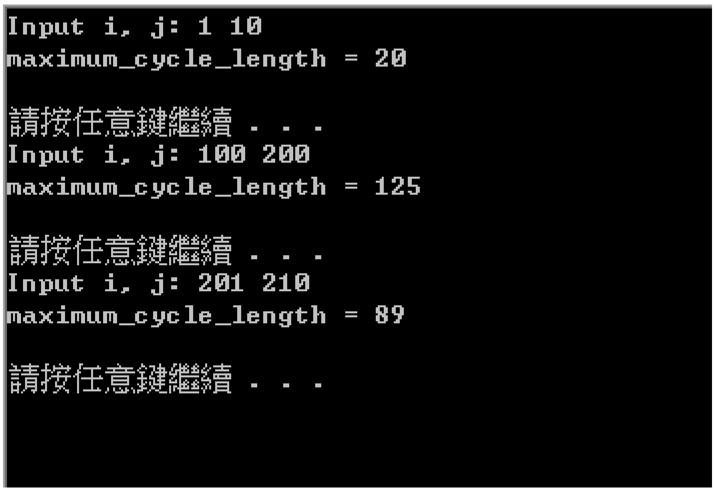
Given the input 22, the following sequence of numbers will be printed 22 11 34 17 52 26 13 40 20 10 5 16 8 4 2 1

It is conjectured that the algorithm above will terminate (when a 1 is printed) for any integral input value. Despite the simplicity of the algorithm, it is unknown whether this conjecture is true. It has been verified, however, for all integers *n* such that 0 < *n* < 1,000,000 (and, in fact, for many more numbers than this.)

Given an input *n*, it is possible to determine the number of numbers printed (including the 1). For a given *n* this is called the *cycle-length* of *n*. In the example above, the cycle length of 22 is 16.

For any two numbers *i* and *j* you are to determine the **maximum** cycle length over all numbers between i and j, **first input i will be the smaller one.**

(Note: When implementing the algorithm, we suggest you use ***while*** instead of ***goto***.)



```
Input i, j: 1 10
maximum_cycle_length = 20

請按任意鍵繼續 . . .
Input i, j: 100 200
maximum_cycle_length = 125

請按任意鍵繼續 . . .
Input i, j: 201 210
maximum_cycle_length = 89

請按任意鍵繼續 . . .
```