CS1021 Tutorial #3 Solution
Condition Code Flags and Basic Flow Control

1 Condition Code Flags

(a) (i) $0100_2 + 0010_2$ Adding two +ve values and result is +ve so V=0

(ii) $0101_2 + 0100_2$ Adding two +ve values and result is -ve so V=1

(iii) $1110_2 + 0101_2$ Adding -ve and +ve value so V=0

(iv) $1101_2 + 1001_2$ Adding two -ve values and result is +ve so V=1

(b) (i) `0x11005000` C=1, V=0, N=0, Z=0

(ii) `0x00000000` C=1, V=0, N=0, Z=1

(iii) `0xB4004100` C=0, V=1, N=1, Z=0

(iv) `0x8F1DD4F2` C=0, V=1, N=1, Z=0

(v) `0x00000000` C=1, V=0, N=0, Z=1

(c) (i) small positive values

(ii) negative value + smaller magnitude positive value

(iii) negative value + larger magnitude positive value

(iv) two small negative values

(v) two values with same magnitude and different signs (e.g. -4 + +4)

(vi) 0 + 0

(vii) two positive values with a sum greater than $2^{31} - 1$

(viii) two negative values with a sum less than -2^{31}

(ix) $-2^{31} + -2^{31}$

2 Flow Control

(a) Compute $x!$

```
1          LDR      r1, =3              ; test with x = 3
2
3          MOV      r0, #1              ; result = 1;
4  while
5          CMP r1, #0                   ; while (x != 0)
6          BEQ      endwh               ; {
7          MUL      r0, r1, r0          ;  result = result * x;
8          SUB      r1, r1, #1          ;  x = x - 1;
9          B        while               ; }
10 endwh
11
12 stop    B        stop
```

(b) (i) Assume x is stored in R0.

```
1          CMP      R0, #0
2          BNE      endIf               ; if (x == 0) {
3          ADD      R0, R0, #5          ;   x = x + 5;
4  endIf                                ; }
```

(ii) Assume x is stored in R0.

```
1          CMP      R0, #0
2          BEQ      else                ; if (x != 0) {
3          MOV      R0, #1              ;   x = 1;
4          B        endIf               ; }
5  els                                  ; else {
6          MUL      R0, R10, R0         ;   x = x * 2;
7  endIf                                ; }
```

(iii) Assume x is stored in R0.

```
1          CMP      R0, #5              ; if (x >= 5)
2          BLO      endIf               ; {
3          MOV      R0, #0              ;   x = 0;
4  endIf                                ; }
```