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 Exam 1 Solutions
 15-213 / 18-213 Fall 2012


 *********
 Problem 1
 *********
 1-a 2-c 3-d 4-c 5-a 6-b 7-c 8-(b or d) 9-c 10-d

 The correct answer for 8 was initially listed as d) temporal locality,
 but the correct answer is actually spatial locality. While it's true
 that blocking in things like matmult primarily exploits temporal
 locality, blocking is effective for transpose because it exploits
 spatial locality by effectively using the entries in each cache line;
 there is no reuse.


 *********
 Problem 2
 *********
  Expression         4b decimal  4b binary   6b decimal   6b binary
 -----------------------------------------------------------------
 -8                |     -8     |  1000    |     -8     |  11 1000
 -TMin             |     -8     |  1000    |    -32     |  10 0000
 x >> 1            |     -3     |  1101    |     -3     |  11 1101
 (-x ^ -1) >> 2    |     -2     |  1110    |     -2     |  11 1110
 -----------------------------------------------------------------


 *********
 Problem 3
 *********
        | A          | B
 One    | 0 011 00  | 0 01 000   Exact in both formats
 1/2    | 0 010 00  | 0 00 100   Exact in both formats, norm in A, denorm in B
 11/8   | 0 011 10  | 0 01 011   Format A round to even, format B exact


 *********
 Problem 4
 *********
 unsigned transform(unsigned n)
 {
     int b, m;

     for(m = 0; n != 0; n >>= 1) { // (or) for(m = 0; n > 0; n = n/2)
         b = n & 1; // (or) b = n % 2;

         if(b == 0) {
             continue;
         }

         m = 2*m + 1; // (or) m = m + m + 1; (or) m = m<<1 + 1;
     }

     return m;
 }


 Alternate solution:
 ------------------
 unsigned transform(unsigned n)
 {
     int b, m;

     for(m = 0; n != 0;) {
         b = !(n & 1); // (or) b = (n % 2) - 1;

         if(b == 0) {
             m = 2*m + 1;
         }

         n = n >> 1;
```

```
        }

    return m;
}
```

```
*********
Problem 5
*********
Part 1.
a X X X X X X b b b b b b b b
c c c d d d X e e e e e e e
f f f f f f f f
```

```
Part 2.
f f f f f f f f b b b b b b b b
e e e e e e e c c c c d d a
```

or

```
a d d d c c c c b b b b b b b b
e e e e e e e f f f f f f f f
```

```
*********
Problem 6
*********
A: phd
B: bachelors
C: masters
```

```
*********
Problem 7
*********
int result = 4;

switch(a){
    case 0:
    case 1:
        c = c - 5;
    case 2:
        result = 4 * c; //or result *= c
        break;
    case 5:
        result = 86547; //or 0x15213
        break;
    case 3:
        c = 2;
    case 7:
        b = b & c;
    default:
        result += b; // or result = b + 4
}

return result;
}
```

```
*********
Problem 8
*********
Stack        The diagram starts with the
addresss     arguments for foo()
          +----------------------------------+
0xffffd850|                 5                |
          +----------------------------------+
0xffffd84c|                 4                |
          +----------------------------------+
0xffffd848|                 3                |
          +----------------------------------+
0xffffd844| caller ra: 0x080483c9            |
          +----------------------------------+
```

```
0xffffd840| old ebp: ffffd858             | <- Part B: %ebp=0xffffd840
         +--------------------------------+
0xffffd83c|                3              |
         +--------------------------------+
0xffffd838|                4              |
         +--------------------------------+
0xffffd834| foo ra: 0x08048397           | <- Part C: esp=0xffffd834
         +--------------------------------+
0xffffd830| old ebp: 0xffffd840          | ok to omit, not part of the stack anymore
         +--------------------------------+
0xffffd82c|                              |
         +--------------------------------+
0xffffd824|                              |
         +--------------------------------+
}
```

```
*********
Problem 9
*********

A. TTSSSBBB

B.
Set:Tag:hit/miss
0:1:M
6:2:M
0:1:H
7:3:M
6:2:H
2:2:M
2:3:M
6:2:H
4:1:M
0:0:M

C. Final state: 0 X 3 X 1 X 2 3 (c)
```