

Homework assignments are to be completed individually. Hand-written submissions are fine, but they must be readable. Due at the beginning of class. Total points: 100, 3.3% of course grade

1. [15 points] Loop Fission and the Kelly and Pugh Transformation Framework

(a) Show whether loop fission is legal or illegal for the following program using the K&P transformation framework.

```
for (i=0; i<N; i++) {
    A[ i ] = ... ;
    ... = A[ i + 1 ];
}
```

(b) Show whether loop fission is legal or illegal for the following program using the K&P transformation framework.

```
for (i=0; i<N; i++) {
    A[ i ] = ... ;
    ... = A[ i - 2 ];
}
```

2. [15 points] Tiling

For the below loop,

```
for (i=0; i<N; i++) {
    for (j=i; j<M; j++) {
        // statements
    }
}
```

show the (a) transformed iteration space, (b) the polyhedral version of the transformed iteration space, and (c) the code generated to implement the tiling $\{[i, j] \rightarrow [t_i, t_j, i, j] \mid t_i = i/3 \text{ and } t_j = j/3\}$.

3. [15 Points] For the following loop,

```
for (i=3; i<100; i++) {
    A[i] = A[i-3];
}
```

answer (a) through (d) from question 11.7.1 in book.

4. [15 Points] Describe the formulation of reindexing on page 848 in the book in a format similar to that of problem 3 in the 2007 HW3 answers.
5. [20 Points] Exercise 12.3.3 in the book.
6. [20 points] Alias Analysis

FSCS

FICS

```
int g;

main() {
    int **a, **b, *c, *d, e, f, *r, *s;

S1    c = foo(&f);

S2    d = foo(&e);

S3    a = &d;

S4    b = &c;

S5    r = *a;

S6    s = *b;

}

int* foo(int *p) {
    int *t;

S7    t = p;

S8    return t;
}
```

For the above program, perform flow-sensitive, context-sensitive alias analysis (FSCS) and flow-insensitive, context-sensitive alias analysis (FICS). Showing your work will help in the assignment of partial credit.

- (a) For FSCS, what is the points-to set for variables `r` and `s` after statement S6?
- (b) For FICS, what is the points-to set for variables `r` and `s` in the `main` function?