Assignment Series 5

Code Transformation and Optimisation

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Consider the following CiviC code fragment:

```
i = 0;
while (i<n) {
  j = 0;
  while (j<m) {
    if (i<j) {
      val = val + i;
    }
    else if (j==i) {
      val = val - 1;
    }
    else {
      val = val + j;
    }
    j = j + 1;
  }
  i = i + 1;
}
```

Assignment 18: Static Single Assignment Form

```
i_0 = 0;
p_0 = i_0 < n;

while ( phi(p_0, p_1) )
{
    j_0 = 0;
    q_0 = j_0 < m;

    while( phi(q_0, q_1) )
    {
        i_1 = phi(i_0, i_2);
        j_1 = phi(j_0, j_2);

        val_4 = phi(val_1, val_2, val_3);
        val_5 = phi(val_0, val_4);


         if (i_1 < j_1) {
            val_1 = val_5 + i_1;
        } else if (j_1 == i_1) {
            val_2 = val_5 - 1;
        } else {
            val_3 = val_5 + j_1;
        }

        j_2 = j_1 + 1;
        q_1 = j_2 < m;
    }

    i_2 = i_1  + 1;
    p_1 = i_2 < n;
}
```

Assignment 19: Machine-Independent Optimisation

Consider the following CiviC code fragment:

```
i = 0;
while (i<n) {
  j = 0;
  while (j<m) {
    if (i<j) {
      val = val + i;
    }
    else if (j==i) {
      val = val - 1;
    }
    else {
      val = val + j;
    }
    j = j + 1;
  }
  i = i + 1;
}
```

After loop-unrolling:

```
i = 0;
while (i < n) {
    j = 0;

    if (i < j ) {
        while (j < m ) {
            val += i;
            j += 1;
        }
    }

    if ( j == i ) {
        while (j < m) {
            val -= 1;
            j += 1;
        }
    }

    if (i > j) {
        while (j < m) {
            val += j;
            j += 1;
        }
    }

    i += 1;
}
```

Of omgeschreven naar for loops:

```
for (int i = 0; i < n; i++) {
        for (int j = 0;  j < i; j++) {
                val += j;
        }

        val -= 1;

        for (j = i + 1; j < m; j++) {
                val += i;
        }
}
```

Assignment 20: Compilation Scheme

Original:

```
    | while (condition) {          |
C   |   Body                       |
    | }                            |
    |   Rest                       |
```

Replacement:

```
     | if (condition) {            |
-> |   do {                       |
     |          C|Body|            |
     |    } while (condition)      |
     | }                           |
     |  C|Rest|                    |
```