# COMP30250 Parallel and Cluster Computing

Assignment 1 – Kimberley Manning – 12251405

All the loops follow the pattern:

for (i=0; i<N; i++) {

a[f(i)] = b[i] \* c[i];

d[i] = a[g(i)] + e;

where

f(i) = a1\*i + a0

g(i) = b1\*i + b0

My personal values were:

* N = 200
* k1 = 0
* k2 = 1
* k3 = 1
* k4 = 1
* k5 = 2
* k6 = 2

**Loop 1.**

f(i) = (N+1)\*i+k1 = 201i + 0

g(i) = (N+1)\*i+k2\*N = 201i + 200

a1 = 201, a0 = 0

b1 = 201, b0 = 200

*GCD test.* No dependence if there is no solution to

201i – 201j = 200, 0 <= i < N, 0 <= j < N

If a solution exists, gcd(201,201) = 201 divides 200 🡪 false, therefore no dependence

**Loop 2.**

f(i) = i + k3\*N = 1i + 200

g(i) = i + (k3+1)\*N = 1i + 400

a1 = 1, a0 = 200

b1 = 1, b0 = 400

*GCD test.* No dependence if there is no solution to

i - j = 200, 0 <= i < N, 0 <= j < N

If a solution exists, gcd(1,1) = 1 divides 200 🡪 true, cannot draw conclusion

*Incomplete Banerjee.* No dependence if functions do not intersect.

i – j: upper bound if i is maximised and j is minimised, vice versa for lower

U = 199 – 0 = 199

L = 0 – 199 = -199

L < 200 🡪 no conclusion

U < 200 🡪 functions do not intersect, therefore no dependence

**Loop 3.**

f(i) = N\*i + k4 = 200i + 1

g(i) = (N+1)\*i + k5 = 201i + 2

a1 = 200, a0 = 1

b1 = 201, b0 = 2

*GCD test.* No dependence if there is no solution to

200i - 201j = 1, 0 <= i < N, 0 <= j < N

If a solution exists, gcd(201,201) = 201 divides 1 🡪 false, therefore no dependence

**Loop 4.**

f(i) = (N+1)\*i = 201i + 0

g(i) = i + (k6+1)\*N = 1i + 600

a1 = 201, a0 = 0

b1 = 1, b0 = 600

*GCD test.* No dependence if there is no solution to

201i - 1j = 600, 0 <= i < N, 0 <= j < N

If a solution exists, gcd(201,1) = 1 divides 600 🡪 true, cannot draw conclusion

*Incomplete Banerjee.* No dependence if functions do not intersect.

201i – j: upper bound if i is maximised and j is minimised, vice versa for lower

U = 201\*199 – 0 = 39999

L = 201\*0 – 199 = -199

L < 600 🡪 no conclusion

U > 600 🡪 no conclusion

*Complete Banerjee.*

Test for antidependence:

0 <= j < i < N

U = 201\*199 – 0 = 39999

L = 201\*1 – 0 = 201

L < 600 🡪 no conclusion

U > 600 🡪 no conclusion 🡪 anti-dependence may or may not exist

Test for true dependence:

0 <= i <= j < N

U = 201\*199 - 1\*199 = 39800

L = 200\*0 – 1\*199 = -199

L < 600 🡪 no conclusion

U > 600 🡪 no conclusion 🡪 true dependence may or may not exist