Architectures des Ordinateurs Avancé: Sujets d'études de cas - 2024

Emmanuel Oseret – Kevin Camus
(emmanuel.oseret@uvsq.fr) – (kevin.camus@uvsq.fr)
Compilateur et options de référence: `gcc -O2`

Sujet 1

```
// ind[] values are between 0 and n-1
void baseline (unsigned n, const double a[n],
               const unsigned ind[n],
               const double b[n],
               double c[n][n])
{
  unsigned i, j;

  for (j=0; j<n; j++)
    for (i=0; i<n; i++)
      c[i][j] = a[ind[j]] / b[i];
}
```

Sujet 2

```
void baseline (unsigned n, const double m[n][n],
               double x[n], const double y[16])
{
  unsigned i, j, k;

  for (i=0; i<n; i++)
    x[i] = 0;

  for (k=0; k<16; k++)
    for (j=0; j<n; j++)
      for (i=0; i<n; i++)
        x[i] += m[i][j] * y[k];
}
```

Sujet 3

```
float baseline (unsigned n,
                const float a[n][n],
                float x)
{
  unsigned i, j;
  float s = 0.0;

  for (j=0; j<n; j++)
    for (i=0; i<n; i++)
      s += a[i][j] / x;

  return s;
}
```

Sujet 4

```
#include <stdlib.h> // malloc, free
#include <math.h> // pow

void baseline (unsigned n, const double a[n][n],
               double b[n][n])
{
   unsigned i, j;

   double (*c)[n] = malloc (n * n * sizeof c[0][0]);

   for (j=0; j<n; j++) {
      for (i=0; i<n; i++) {
         if (i < j) {
            c[i][j] = 0.0;
         } else if (i > j) {
            c[i][j] = 2.0;
         } else {
            c[i][j] = 1.0;
         }
      }

      for (i=0; i<n; i++) {
         b[i][j] = pow (a[i][j], c[i][j]);
      }
   }

   free (c);
}
```

Sujet 5

```
#include <math.h> // fmin (C99), exp

float baseline (unsigned n, const float a[n],
                const float b[n])
{
   float min = 0.0;

   unsigned i, j;
   for (i=0; i<n; i++) {
      for (j=0; j<n; j++) {
         if (i == 0 && j == 0)
            min = exp (a[i] + b[j]);
         else
            min = fmin (min, exp (a[i] + b[j]));
      }
   }

   return min;
}
```

Sujet 6

```
#include <math.h> // pow, log

void baseline (unsigned n, double a[n][n],
               const float b[n],
               const float c[n])
{
  unsigned i, j;

  for (j=0; j<n; j++)
    for (i=0; i<n; i++)
      a[i][j] = log (pow (b[i], c[j]);
}
```

Sujet 7

```
void baseline (unsigned n, double x[n],
               const double y[n],
               const double z[n][n])
{
  unsigned i, j;

  for (j=0; j<n; j++)
    for (i=0; i<n; i++)
      x[i] += z[i][j] / y[i];
}
```

Sujet 8

```
#include <math.h> // cos, sin, tan

void baseline (unsigned n, float a[n][n],
               const float b[n])
{
   unsigned i, j;

   for (j=0; j<n; j++) {
      for (i=0; i<n; i++) {
         if (i%4 == 0) {
            a[i][j] = cos(b[i]) / sin(b[j]);
         } else if (i%4 == 1) {
            a[i][j] = tan(b[i]) / tan(b[j]);
         } else if (i%4 == 2) {
            a[i][j] = cos(b[j]) / sin(b[i]);
         } else { // i%4 == 3
            a[i][j] = tan(b[j]) / tan(b[i]);
         }
      }
   }
}
```

Sujet 9

```
void baseline (unsigned n, float x[n][n],
               const float y[n][n], double c)
{
   unsigned i, j;

   for (j=2; j<n-2; j++)
      for (i=2; i<n-2; i++)
         x[i][j] = (y[i-2][j+0] +
                    y[i-1][j+0] +
                    y[i+1][j+0] +
                    y[i+2][j+0] +
                    y[i+0][j-2] +
                    y[i+0][j-1] +
                    y[i+0][j+1] +
                    y[i+0][j+2]) / c;
}
```

Sujet 10

```c
#include <stdlib.h> // malloc, qsort, free
#include <math.h> // fabs, fmax (C99)

static int cmp_double (const void *p1,
                       const void *p2)
{
  const double x = *((double *) p1);
  const double y = *((double *) p2);
  if (x < y) return -1;
  if (x > y) return  1;
  return 0;
}

// Computes maximum absolute difference
double baseline (unsigned n, const double a[n][n],
                 const double b[n][n])
{
  double max = 0.0f;

  unsigned i, j;
  for (i=0; i<n; i++) {
    double *tmp = malloc (n * sizeof tmp[0]);

    for (j=0; j<n; j++) {
      tmp[j] = fabs (a[i][j] - b[i][j]);
    }
    qsort (tmp, n, sizeof tmp[0], cmp_double);
    max = fmax (max, tmp[n-1]);

    free (tmp);
  }

  return max;
}
```

Sujet 11

```
#include <math.h> // log

void baseline (unsigned n, float a[n][n],
               const float b[n][n],
               float x)
{
   unsigned i, j, k;
   for (j=0; j<n; j++)
     for (i=0; i<n; i++)
       for (k=0; k<6; k++)
         a[i][j] += log (x) * b[k][j];
}
```

Sujet 12

```
void baseline (unsigned n, const double a[n][n],
               const double b[n], double c[n])
{
  unsigned i, j;

  for (j=0; j<n; j++)
    for (i=0; i<n; i++) {
      c[i] -= b[n - 1 - i];
      if (i < j)
        c[i] += a[i][j];
    }
}
```

Sujet 13

```
void baseline (unsigned n, double a[n],
               const float b[n],
               const float c[n],
               const float d[12])
{
  unsigned k, i;

  // all elements in b are assumed positive
  for (k=0; k<12; k++) {
    for (i=0; i<n; i++) {
      if (b[i] >= 0.0 && b[i] < 1.0) {
        a[i] += exp (b[i] + d[k]) / c[i];
      } else if (b[i] >= 1.0) {
        a[i] += (b[i] * d[k]) / c[i];
      }
    }
  }
}
```