ENCM 339 Fall 2015 Exam Solutions

Steve Norman
Department of Electrical & Computer Engineering
University of Calgary

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Introduction

These solutions were prepared in December 2016, without access to notes used to mark exams in December 2015. It's possible that there are some mistakes here!

SECTION 1

1. (c) (The value of `*b` is `&a[0]` and the value of `b[1]` is `&a[2]`.)
2. (b) (The type of `cs` is `const char *`, so `cs` can't be used to change the value of a `char`.)
3. (d)
4. (b)
5. (c)
6. (c)
7. (b) or (d) (The correct answer was accidentally listed twice.)
8. (a) (`doubled(y)` gets preprocessed into `(y-1 * 2)`, and `*` has higher precedence than the `-` operator.)
9. (d) (The constructor call is equivalent to `Point p1(100, -99);`.)
10. (c)

SECTION 2

Question 1. 8 bytes.

Question 2. 1. (`fwrite` returns the number of items written; this information could be found in the *Reference Material*.)

Question 3. `'0'`, `'.'`, `'6'`, `'6'`, `'6'`, `'6'`, `'6'`, `'6'`.

Question 4.

```
char * copystr (const char* source) {
  char *dest;

  dest = malloc(strlen(source) + 1);

  strcpy(dest, source);
  return dest;
}
```

Question 5.

```
8
9
10
```

SECTION 3

Part 1.

```
bool up_then_down(const int* arr, int n) {
  if (n == 1)
    return true;

  int i_of_max = 0;
  for (int i = 0; i < n; i++)
    if (arr[i] > arr[i_of_max])
      i_of_max = i;

  for (int i = 1; i <= i_of_max; i++)
    if (arr[i] <= arr[i - 1])
      return false;

  for (int i = i_of_max + 1; i < n; i++)
    if (arr[i] >= arr[i - 1])
      return false;

  return true;
}
```

Part 2.

```
bool all_diff(const char *left, const char *right)
{
  for (int i = 0; left[i] != '\0'; i++)
    for (int j = 0; right[j] != '\0'; j++)
      if (left[i] == right[j])
        return false;

  return true;
}
```

SECTION 4

Question 1.

```
IntVector::IntVector(const IntVector& src)
  : storeM(0), end_validM(0), end_storeM(0)
{
  if (src.size() == 0)
    return;
  storeM = new int[src.size()];
  end_storeM = end_validM = storeM + src.size();
  for (size_t i = 0; i < src.size(); i++)
    storeM[i] = src.storeM[i];
}
```

Question 2.

```
IntVector::~IntVector() {
  delete [ ] storeM;
}
```

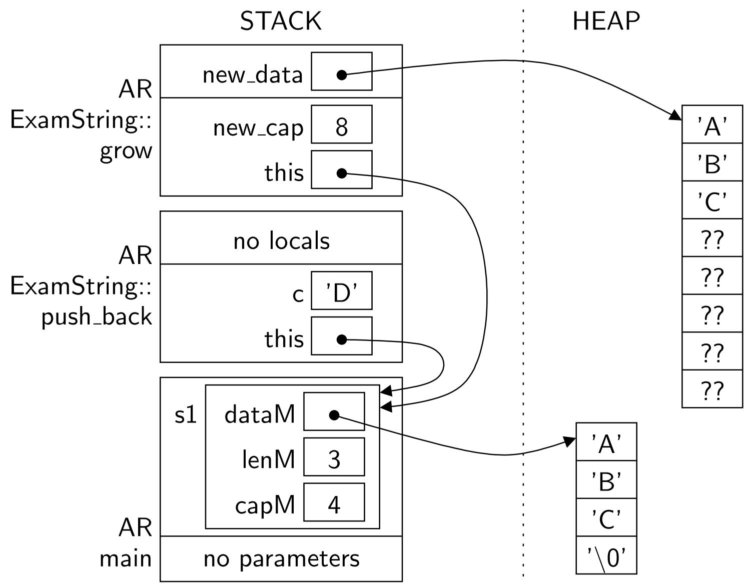
Question 3.

```
void IntVector::remove_all(int val) {
  size_t new_index = 0;
  for (size_t old_index = 0; old_index < size(); old_index++)
    if (storeM[old_index] != val) {
      storeM[new_index] = storeM[old_index];
      new_index++;
    }
  end_validM = storeM + new_index;
}
```

SECTION 5

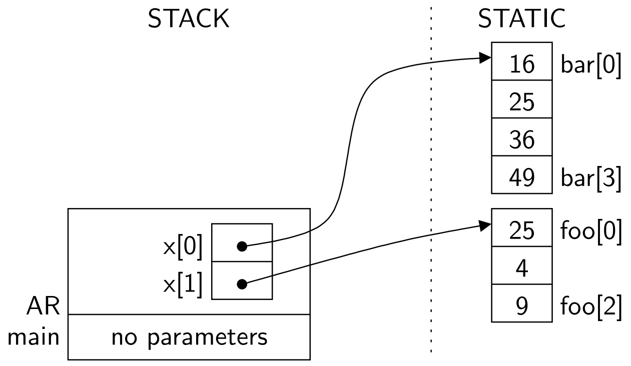
[This section was about linked lists, which is not a topic in ENCM 339 in Fall 2016.]

SECTION 6



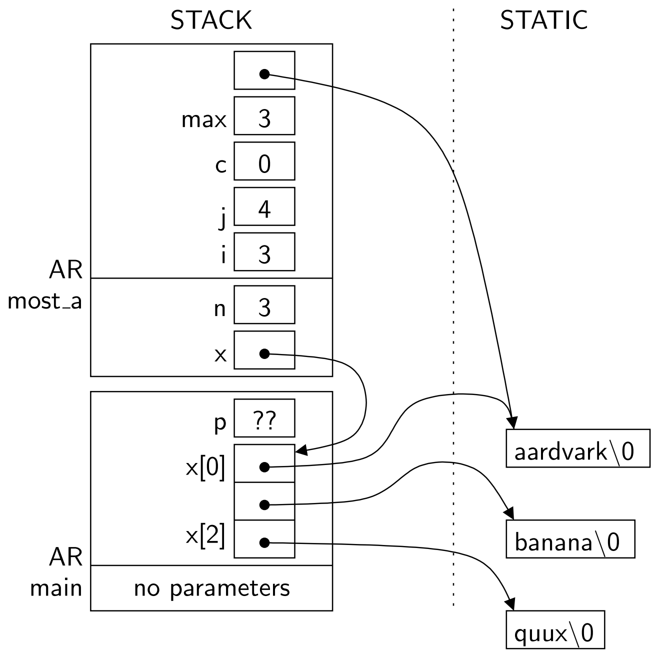
SECTION 7

Part a.



Part b.

(The style used here for drawing string constants is acceptable if pointers are pointing at the starts of strings, but not if a pointer points one or more `char`s away from the start of a string.)



SECTION 8

Part a.

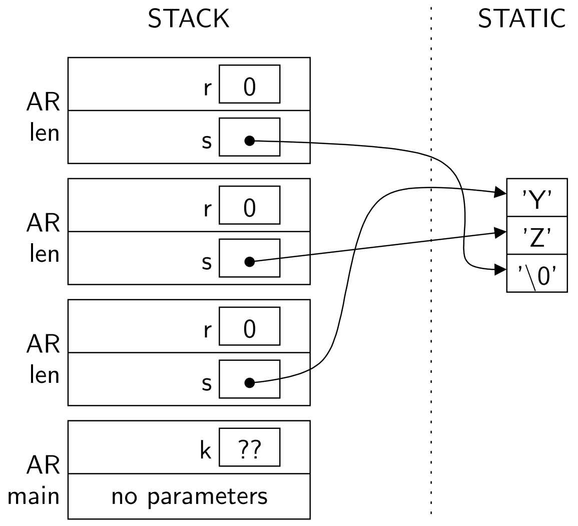
```
double max_brightness(const Image& im)
{
  double max_sum = 0.0;
  for (size_t r = 0; r < im.nrow(); r++) {
    for (size_t c = 0; c < im.ncol(); c++) {
      Pixel p = im.get_pixel(r, c);
      double sum = p.r + p.g + p.b;
      if (sum > max_sum)
        max_sum = sum;
    }
  }
  return max_sum / 765.0;
}
```

Part b.

```
Image mirror(const Image& im)
{
  Image result = Image(im.nrow(), im.ncol());
  for (size_t r = 0; r < im.nrow(); r++) {
    size_t im_c = im.ncol() - 1;
    for (size_t c = 0; c < im.ncol(); c++) {
      result.set_pixel(r, c, im.get_pixel(r, im_c));
      im_c--;
    }
  }
  return result;
}
```

SECTION 9

Part a.



Part b.

```
int first_match(const int *a, int lo, int hi, int key)
{
  int result;
  if (lo == hi - 1) {   // base case, only 1 element
    result = (a[lo] == key) ? lo : -1;
    return result;
  }

  int mid = (lo + hi) / 2;
  result = first_match(a, lo, mid, key);
  if (result == -1)
    result = first_match(a, mid, hi, key);

  return result;
}
```

SECTION 10

Binary file operations with the standard C++ library were not a topic in ENCM 339 in Fall 2016. But binary file operations with the standard C library were, so I thought it would be helpful to convert this into a C programming problem, then solve it ...

```
#include <stdio.h>
#include <stdlib.h> // for exit
#include <stdint.h> // for uint16_t

int main(int argc, char **argv) {
  if (argc != 2) {
    fprintf(stderr, "Error: need exactly one command-line argument.\n");
    exit(1);
  }
  FILE *fp = fopen(argv[1], "rb");
  if (fp == NULL) {
    fprintf(stderr, "Error: could not open %s for input.\n", argv[1]);
    exit(1);
  }

  char first4[4];
  uint16_t n_row, n_col;
  size_t nread = fread((void *) first4, 1, 4, fp);

  // Code above this comment is the C equivalent to the C++ code
  // given on the quetion paper.

  // Code below this comment is the solution to the C programming
  // version of this problem.

  if (nread != 4) {
    fprintf(stderr, "Error: could not read first 4 bytes of file.\n");
    exit(1);
  }
  if (first4[0] != 'i' || first4[1] != 'm'
      || first4[2] != 'g' || first4[3] != 'X') {
    fprintf(stderr, "Error: First 4 bytes of file are incorrect.\n");
    exit(1);
  }

  nread = fread((void *) &n_row, 1, sizeof(uint16_t), fp);
  if (nread == 2)
    nread = fread((void *) &n_col, 1, sizeof(uint16_t), fp);
  if (nread != 2) {
    fprintf(stderr, "Error: failed to read row and/or column counts.\n");
    exit(1);
  }
  printf("File seems to be OK, with %d rows and %d columns.\n",
         (int) n_row, (int) n_col);

  return 0;
}
```