Mark Shimozaki

Homework 4

Cpts 350

1. Sorting Babies by hair color, Brown then purple

Details:

- one pointer starts at the beginning of the array on the left, it would look for purple hair babies for swapping.
- second pointer starts at the othe end of the array and looks for brown hair babies.
- The sorting will stop when the left pointer is ≥ right pointer which means the algorithm is one pass and in linear time. The in-place requirement is satisfied since the algorithm is swapping elements without using extra space.

possible sample code / C:

```
    void Swap (int* a, int*b)
          int temp = *a;
          *a = *b;
          *b = temp;
  //sort array with brown(0) and purple (1) haired
   babies
  Void sortBabiesByHairColor(int A[], int size)
        int  left=0, right= size-1;
        while (left < right) {
               while(left <right && A[left] == 0) left ++;
               while (left < right && A[right]== 1) right--;
               if ( left < right) {
                    Swap (&A[left], &A[right]);
                    left ++;
                    right --;
for(int=i=0; i < Size; i++)          }
                                   }
{                                 }                 0 for brown
    print('%d', A[i]);                              1 for purple
 }                                int  main(){
 return 0;                                     int A[] = {1,0,1,0,1,0,1,1};
}                                              int size = sizeof(A)/sizeof(A[0]);
                                               sortBabiesByHairColor(A, size);
```

2. Sorting Babies by Hair Color; Brown, followed by purple, followed by black

- For sorting with three distinct categories, you have to add another pointer.

Sample code / C: # similar to previous code

```
void swap (int* a, int* b){
        int temp = *a;
        *a = *b;
        *b = temp;
}

void SortBabiesByThreeColors( int A[], int size)
{
    int low = 0, mid = 0, high = size - 1;

    while (mid <= high) {
        if (A[mid] == 0){
            // Brown
            swap(&A[low], &A[mid]);
            low++;
            mid++;
        } else if (A[mid] == 1) {
            // purple
            mid++;
        } else {
            swap(&A[mid], &A[high]);
            high--;
        }
    }
}

int main() {                                    // brown 0, purple 1,
                                                   black 2
        int A = {2, 1, 0, 2, 1, 0, 2, 1, 2}
        int size = sizeof(A) / sizeof(A[0]);
        SortBabiesByThreeColors(A, size);
    for (int i = 0; i < size; i++) { printf("%d", A[i]);
```

explanation:

three pointers is necessary and sufficient for this problem because each pointer is responsible for positioning one of the three hair colors correctly.