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/*
Using the queue ADT
edit from http://www.dreamincode.net/forums/topic/49439-concatenating-queues-in-c/
bin>bcc32 queue.cpp
*/
#include <stdio.h>
#include <stdlib.h>
//      Queue ADT Type Defintions
        typedef struct node
         {
          void*          dataPtr;
          struct node* next;
         } QUEUE_NODE;
        typedef struct
         {
          QUEUE_NODE* front;
          QUEUE_NODE* rear;
          int              count;
         } QUEUE;

//      Prototype Declarations
        QUEUE* createQueue  (void);
        QUEUE* destroyQueue (QUEUE* queue);

        bool  dequeue   (QUEUE* queue, void** itemPtr); // ** keep number in memory
        bool  enqueue   (QUEUE* queue, void*  itemPtr);
        bool  queueFront (QUEUE* queue, void** itemPtr);
        bool  queueRear  (QUEUE* queue, void** itemPtr);
        int   queueCount (QUEUE* queue);
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        bool  emptyQueue (QUEUE* queue);
        bool  fullQueue  (QUEUE* queue);
//      End of Queue ADT Definitions

void printQueue         (QUEUE* stack);

int main (void)
{
//      Local Definitions
        QUEUE* k1;
        QUEUE* w2;
        int*   numPtr;
        int** itemPtr;

//      Statements
        // Create two queues
        k1 = createQueue();
        w2 = createQueue();
        for (int wiw = 10; wiw <= 25; wiw++)
          {

                numPtr  = (int*)malloc(sizeof(wiw)); // set pointer to memory
                *numPtr = wiw;
                enqueue(k1, numPtr);


          }
        for (int wiw = 25; wiw >= 10; wiw--)
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        {

                numPtr  = (int*)malloc(sizeof(wiw)); // set pointer to memory
                *numPtr = wiw;
                enqueue(w2, numPtr);



        } // for
        printf ("Queue 1: ascending \n");
        printQueue (k1); // 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
        printf ("Queue 2: descending \n");
        printQueue (w2); // 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10
        return 0;
}

/*      ================= createQueue ================
        Allocates memory for a queue head node from dynamic
        memory and returns its address to the caller.
          Pre     nothing
          Post    head has been allocated and initialized
          Return head if successful; null if overflow
*/
QUEUE* createQueue (void)
{
//      Local Definitions
        QUEUE* queue;
//      Statements
        queue = (QUEUE*) malloc (sizeof (QUEUE));
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```
        if (queue)
          {
                queue->front  = NULL;
                queue->rear   = NULL;
                queue->count  = 0;
          } // if
        return queue;
}       // createQueue

/*      ================= enqueue ================
        This algorithm inserts data into a queue.
          Pre     queue has been created
          Post    data have been inserted
          Return true if successful, false if overflow
*/
bool enqueue (QUEUE* queue, void* itemPtr)
{
//  Local Definitions
//          QUEUE_NODE* newPtr;
//  Statements
//          if (!(newPtr = (QUEUE_NODE*)malloc(sizeof(QUEUE_NODE)))) return false;
          QUEUE_NODE* newPtr = (QUEUE_NODE*)malloc(sizeof(QUEUE_NODE));
        newPtr->dataPtr = itemPtr;
        newPtr->next    = NULL;
        if (queue->count == 0)
          // Inserting into null queue
          queue->front  = newPtr;
        else
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        queue->rear->next = newPtr;
    (queue->count)++;
    queue->rear = newPtr;
    return true;
}   // enqueue

/*  ================= dequeue ================
    This algorithm deletes a node from the queue.
      Pre   queue has been created
      Post  Data pointer to queue front returned and
                front element deleted and recycled.
      Return true if successful; false if underflow
*/
bool dequeue (QUEUE* queue, void** itemPtr)
{
//  Local Definitions
    QUEUE_NODE* deleteLoc;
//  Statements
    if (!queue->count)
        return false;
    *itemPtr  = queue->front->dataPtr;
    deleteLoc = queue->front;
    if (queue->count == 1)
      // Deleting only item in queue
      queue->rear  = queue->front = NULL;
    else
      queue->front = queue->front->next;
    (queue->count)--;
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        free (deleteLoc);
        return true;
}       // dequeue

/*      ================== queueFront =================
        This algorithm retrieves data at front of the queue
        queue without changing the queue contents.
          Pre   queue is pointer to an initialized queue
          Post  itemPtr passed back to caller
          Return true if successful; false if underflow
*/
bool queueFront (QUEUE* queue, void** itemPtr)
{
//      Statements
        if (!queue->count)
                return false;
        else
          {
                *itemPtr = queue->front->dataPtr;
                 return true;
          } // else
}       // queueFront

/*      ================== queueRear =================
        Retrieves data at the rear of the queue
        without changing the queue contents.
          Pre   queue is pointer to initialized queue
          Post  Data passed back to caller
          Return true if successful; false if underflow
```

```
*/
bool queueRear (QUEUE* queue, void** itemPtr)
{
//      Statements
        if (!queue->count)
                return true;
        else
          {
                *itemPtr = queue->rear->dataPtr;
                return false;
          } // else
}       // queueRear

/*      ================== emptyQueue =================
        This algorithm checks to see if queue is empty
        Pre     queue is a pointer to a queue head node
        Return true if empty; false if queue has data
*/
bool emptyQueue (QUEUE* queue)
{
//      Statements
        return (queue->count == 0);
}       // emptyQueue

/*      ================== fullQueue =================
        This algorithm checks to see if queue is full. It
        is full if memory cannot be allocated for next node.
          Pre   queue is a pointer to a queue head node
          Return true if full; false if room for a node
```

```
*/
bool fullQueue (QUEUE* queue)
{
//      Check empty
if(emptyQueue(queue)) return false; // Not check in heap
//      Local Definitions *
QUEUE_NODE* temp;
//      Statements
        temp = (QUEUE_NODE*)malloc(sizeof(*(queue->rear)));
        if (temp)
          {
                free (temp);
                return false; // Heap not full
          } // if
        return true; // Heap full
}       // fullQueue

/*      ================== queueCount =================
        Returns the number of elements in the queue.
          Pre   queue is pointer to the queue head node
          Return queue count
*/
int queueCount(QUEUE* queue)
{
//      Statements
        return queue->count;
}       // queueCount

/*      ================== destroyQueue ================
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            Deletes all data from a queue and recycles its
            memory, then deletes & recycles queue head pointer.
              Pre     Queue is a valid queue
              Post    All data have been deleted and recycled
              Return null pointer
*/
QUEUE* destroyQueue (QUEUE* queue)
{
//          Local Definitions
            QUEUE_NODE* deletePtr;
//          Statements
            if (queue)
              {
                    while (queue->front != NULL)
                      {
                            free (queue->front->dataPtr);
                            deletePtr          = queue->front;
                            queue->front = queue->front->next;
                            free (deletePtr);
                      } // while
                    free (queue);
              } // if
            return NULL;
}           // destroyQueue

/*          ================== printQueue ================
            A non-standard function that prints a queue. It is
            non-standard because it accesses the queue structures.
              Pre  queue is a valid queue
              Post queue data printed, front to rear
```

```
*/
void printQueue(QUEUE* queue)
{
//      Local Definitions
        QUEUE_NODE* node = queue->front;
//      Statements
        printf ("Front=>");
        while (node)
          {
                printf ("%3d", *(int*)node->dataPtr);
                node = node->next;
          } // while
        printf(" <=Rear\n");
        return;
}       // printQueue
```