ECE 103 Engineering Programming

Expanded Homework HW-6
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Shaun Crippen
crippen@pdx.edu

Problem Description
Create a program that determines the number of combinations of 21 in a shuffled deck of playing cards. The program will first simulate a randomized shuffling of a sorted 52 deck. Cards will be drawn consecutively until the combined value of the cards is 21 (win) or over 21 (bust), and the procedure will continue until the deck is used up. Display the cards drawn and if the set is a "win" or a "bust", as well as the total number of "wins" and "busts" for the deck. Also display when card deck is depleted.

Design Approach
Inputs & Outputs

- The input is the user-provided seed value for shuffling the deck.
- The three outputs are:
    - Displayed deck before shuffling.
    - Displayed deck after shuffling.
    - Displayed list of cards drawn and their outcome ("win", "bust", or "out of cards"). Each new draw sequence will be on a separate line.
    - Displayed total "wins" and total "busts".

Assumptions

- Card deck will be standard 52-card deck.
- Card deck will be 1-D array of structures representing each card.
- Card structures will hold each card's rank, suit, and value.
- Shuffling algorithm will swap the first card with a random card, swap the second card with a random card, and so on until all card locations have been swapped at least once.
- Shuffling will be done using a separate function.
- Shuffled deck sequence will be the same each time the program is ran if seed value is not changed.
- Enumerated type will be implemented to define suit values.
- User will only enter a positive integer for seed value followed by "Enter" when prompted.

Method

- Prompt user to provide seed for srand() function.
- Declare card structure that includes card rank, suit, and value.
- Create array of 52 card structures.
- Fill array of structures with each card's rank, suit, and value in the deck.
- Display sorted deck into four columns, one for each suit.
- Call shuffling function.
    - Pass in structure array
    - In FOR loop, switch each array element (structure) at index location with a pseudorandom element (based on user seed).
- Display shuffled deck in same manner as sorted (4 columns, each column having 13 cards).
- Display combinations of 21 of shuffled deck.
    - Display cards from each series with outcome (win, bust, or out of cards)

- Keep track if an ace has been drawn during series
- If changing an ace's value to 11 will get 21, change an ace card's value.
- Keep running total of number of wins and bust and display after out of cards.

Logic Flow

Program

```
DECLARE suit enumerations
DECLARE array of pointers to Unicode strings for suit symbols
DECLARE card structure with members
   character pointer Rank
   integer Suit
   integer Value

Function prototypes for displaying card deck and shuffling card deck functions

MAIN
   DECLARE program to use UTF-8 character set to display suit symbols
   DECLARE array of pointers for card ranks A, 2, 3,…, K
   DECLARE deck as array of 52 card structures

   DISPLAY message asking user to enter seed value
   Get seed value

   FOR each card structure (index 0-51)          // Populate card structures in deck array
      Populate members Rank, Suit, and value     // Rank A-K, Suit 0-4, Value 1-10 (assume Ace initially as 1)
   END FOR loop

   CALL display function with card deck array as argument to display sorted card deck.

   CALL shuffle function with card deck array and seed value as arguments to shuffle card deck.

   CALL display function with card deck as argument to display shuffled deck.

   // Combinations of 21
   DECLARE and INITIALIZE drawn card value total, ace flag, win total, and bust total to zero

   FOR all 52 cards in deck        // drawing consecutive cards from top of deck
      DISPLAY drawn card
      Add drawn card's value to running total

      IF ace is drawn
         Increment ace flag by 1
      END IF statement

      IF changing a single drawn ace's value to 11 will get total of 21 (win)
         Increment running total by 10
      END IF statement

      IF running total equals 21
         DISPLAY message after current drawn card series that series resulted in win
```

```
            SET running total to 0
            SET ace flag to 0
            Increment win total by 1
        ELSE IF running total is over 21
            DISPLAY message after current drawn card series that series resulted in bust
            SET running total to 0
            SET ace flag to 0
            Increment bust total by 1
        END IF statement
    END FOR loop

    DISPLAY message that card deck is out of cards
    DISPLAY message of win total
    DISPLAY message of bust total
    DISPLAY end of game message

END MAIN

DISPLAY DECK FUNCTION, passing card deck array into function
    FOR all 13 ranks in deck                                    // 13 cards per column
        DISPLAY 1st (index), 13th (index + 13), 26th (index + 13*2), and 39th (index + 13*3) cards (rank and suit
                symbol) in a row, separated by a "tab"          // 4 columns per row
END DISPLAY DECK FUNCTION

SHUFFLE DECK FUNCTION, passing card deck array and user seed value into function
    DECLARE card structure type temp card
    DECLARE integer swap index

    Seed random number generator using user seed value

    FOR all 52 cards in deck
        CALL random number generator (RNG) to generate number between 0-51
        ASSIGN temp card with card at current index
        ASSIGN card at current index with card at index number generated by RNG
        ASSIGN card at RNG index with the card in temp card variable (card at current index)
    END FOR loop
END SHUFFLE DECK FUNCTION

END PROGRAM
```