

Today: Structures and arrays

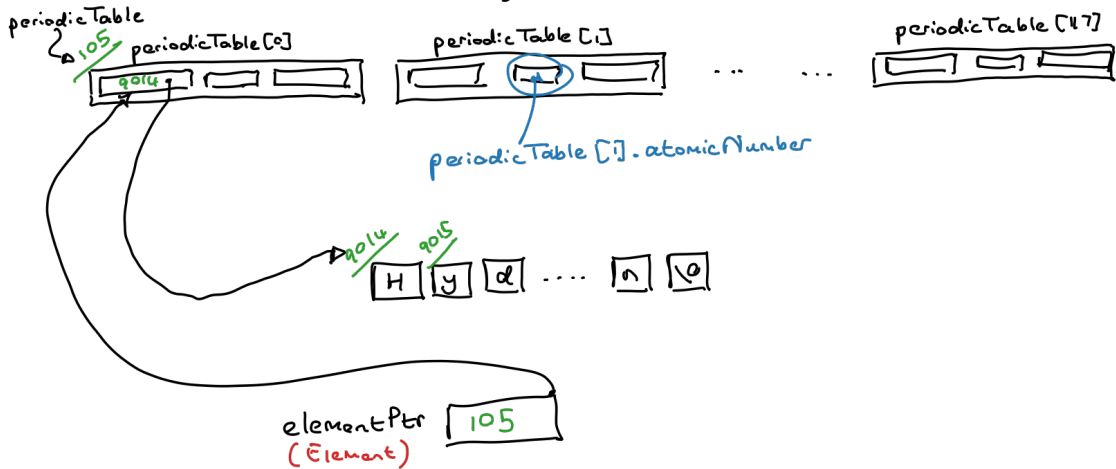
Computer Programming 143 – Lecture 23

C Structures II

Faculty of Engineering



Arrays of structures



malloc() and Structures I

Creating an array of structures during runtime

```
typedef struct {
    char *name;
    int atomicNumber;
    double atomicMass;
} Element; // defines structure type Element

int numberOfElements = 118;
Element *periodicTableOfElements; // pointer to structure type Element

// reserves space for numberOfElements amount of structures of type
// Element
periodicTableOfElements = malloc( numberOfElements * sizeof( Element ) );
periodicTableOfElements[0].name = "Hydrogen";

free( periodicTableOfElements ); // frees memory allocated previously
```

10.7 Example: Card Shuffling and Dealing

Problem statement

Design and implement an algorithm that shuffles and deals a 52-card deck

7.11 Card Shuffling and Dealing II

Deck representation

```
int deck[ 4 ][ 13 ];
```

		Ace	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Jack	Queen	King
		0	1	2	3	4	5	6	7	8	9	10	11	12
Hearts	0	9	1	52	7	.	.	.	.	.				
Diamonds	1													
Clubs	2													
Spades	3													

deck[2][12] represents the King of Clubs

The value stored in deck[2][12], represents the card's unique position in the deck

7.11 Card Shuffling and Dealing III

Empty Deck representation

		Ace	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Jack	Queen	King
		0	1	2	3	4	5	6	7	8	9	10	11	12
Hearts	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diamonds	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Clubs	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Spades	3	0	0	0	0	0	0	0	0	0	0	0	0	0

7.11 Card Shuffling and Dealing IV

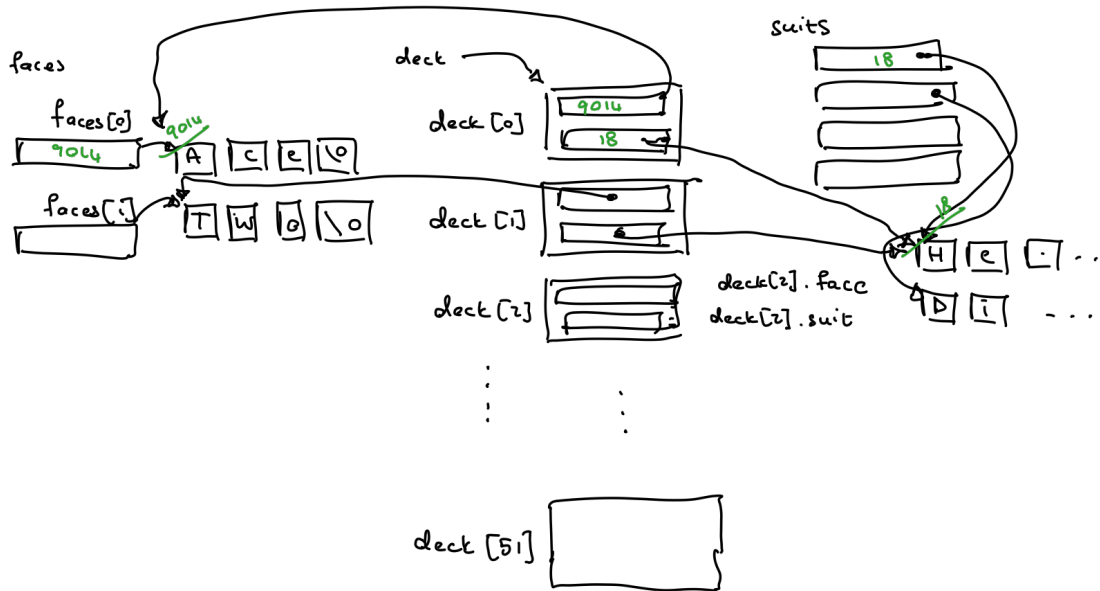
Ordered Deck representation

		Ace	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Jack	Queen	King
		0	1	2	3	4	5	6	7	8	9	10	11	12
Hearts	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Diamonds	1	14	15	16	17	18	19	20	21	22	23	24	25	26
Clubs	2	27	28	29	30	31	32	33	34	35	36	37	38	39
Spades	3	40	41	42	43	44	45	46	47	48	49	50	51	52

7.11 Card Shuffling and Dealing V

Shuffled Deck representation

		Ace	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Jack	Queen	King
		0	1	2	3	4	5	6	7	8	9	10	11	12
Hearts	0	26	51	16	44	36	15	50	46	3	38	52	40	10
Diamonds	1	11	19	34	27	1	20	47	21	25	4	32	18	31
Clubs	2	6	35	8	9	37	2	49	29	22	13	5	42	33
Spades	3	12	7	23	45	24	41	28	14	39	30	48	43	17



10.7 Example: Data structure

