## 19.4 A Stack Abstract Data Type

To illustrate how abstract data types can be encapsulated using incomplete types, we'll develop a stack ADT based on the stack module described in Section 19.2. In the process, we'll explore three different ways to implement the stack.

### Defining the Interface for the Stack ADT

First, we'll need a header file that defines our stack ADT type and gives prototypes for the functions that represent stack operations. Let's name this file `stackADT.h`. The `Stack` type will be a pointer to a `stack_type` structure that stores the actual contents of the stack. This structure is an incomplete type that will be completed in the file that implements the stack. The members of this structure will depend on how the stack is implemented. Here's what the `stackADT.h` file will look like:

*stackADT.h (version 1)*

```
#ifndef STACKADT_H
#define STACKADT_H

#include <stdbool.h>    /* C99 only */

typedef struct stack_type *Stack;

Stack create(void);
void destroy(Stack s);
void make_empty(Stack s);
bool is_empty(Stack s);
bool is_full(Stack s);
void push(Stack s, int i);
int pop(Stack s);

#endif
```

Clients that include `stackADT.h` will be able to declare variables of type `Stack`, each of which is capable of pointing to a `stack_type` structure. Clients can then call the functions declared in `stackADT.h` to perform operations on stack variables. However, clients can't access the members of the `stack_type` structure, since that structure will be defined in a separate file.

Note that each function has a `Stack` parameter or returns a `Stack` value. The stack functions in Section 19.3 had parameters of type `Stack *`. The reason for the difference is that a `Stack` variable is now a pointer; it points to a `stack_type` structure that stores the contents of the stack. If a function needs to modify the stack, it changes the structure itself, not the pointer to the structure.

Also note the presence of the `create` and `destroy` functions. A module