LAB 2 - TASK 4 through TASK 5
Stacks / Millionaire

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Stacks are used extensively to check the syntax of a programming language.

TASK 4. Stacks

The stack.c program below almost works, but I must have been up too late and made a bunch of silly errors.

Copy and paste the stack.c program into stack.c on your computer and fix the errors. After pasting the stack.c program onto your Ubuntu system, format your program by running "**gg=G**" in vi.

Pay attention to the basics on how the stack works. Programming languages like to push items onto the stack, then pop a few items, modify the popped data, and then push the result back onto the stack.

john@oho:~/LAB2$ **cat stack.c**
```
#include <stdio.h>
#include <string.h>

#define MAX_STACK_SIZE 8
#define MAX_LENGTH 50

char data[40]
char stack[MAX_STACK_SIZE][MAX_LENGTH];
int top = -1;

int isempty() {
  if(top == -1)
    return 1;
  else
    return 0;
}

int isfull() {
  if(top == MAX_STACK_SIZE)
    return 1;
  else
    return 0;
}
```

```c
char *peek() {
  return stack[top];
}

char *pop() {
  if(!isempty()) {
    strcpy(data, stack[top]);
    top = top - 1;
    if (top == -1)
      printf("Pop \"%d\" off of stack. Stack is empty.\n", data);
    else
      printf("Pop \"%s\" off of stack. Top of stack contains: %s\n", data, stack[top]);
    return data;
  } else {
    printf("Error: Could not pop data. Stack is empty.\n");
  }
}

char *push(char *data) {
  if(!isfull()) {
    top = top + 1;
    data = stack[top];
    printf("Push \"%s\" onto stack.\n", data);
  } else {
    printf("Error: Could not push \"%s\" onto stack. Stack is full.\n", data);
  }
}

int main() {
  push("Islands");
  push("Channel");
  printf("There are %d items on stack. Top of stack is: %s\n\n", top+1, peek());

  push("San");
  push("Diego");
  printf("There are %d items on stack. Top of stack is: %s\n\n", top+1, peek());

  pop();
  pop();
  printf("There are %d items on stack. Top of stack is: %s\n\n", top+1, peek());

  push("to CSU");
  push("Welcome");
  printf("There are %s items on stack. Top of stack is: %d\n\n", top+1, peek());

  printf("All done adding.\n");

  printf("Value at the top of the stack is: %s\n" ,peek());
```

```c
    printf("Pop everything off stack.\n");
    printf("---------------------------\n");

    while(!isempty()) {
        pop();
        printf("%s\n",data);
    }
    printf(--------------------------\n");
    return 0;
}
```

TASK 5. Who Wants to Be a Millionaire?

As you get closer to your graduation from Channel Islands, the last thing on your mind is, well, retirement. But you've heard about the power of **compound interest** and you want to learn more. You want to know if contributing to your 401lk can make you a millionaire?

To run the retire program, there are two input parameters:

1. How old you are when you start to save?
2. How much you consistently save per month until your retirement age of 65?

Copy/Paste the following retire.c template to start with:

```
john@oho:~/232/LAB2$ cat retire.c
#include <stdio.h>
#include <stdlib.h>

#define  SALARY   100000          // $100k/year

void main(int argc, char *argv[])
{
        int after_tax_distribution = 0;
        int age = 0;
        int amount = 0;
        int distribution = 0;
        int i = 0;
        int matching_401k_amount = 0;
        int max_matching_401k_amount = 0;
        int principle = 0;
        int roth_distribution = 0;      // Need to determine.
        int taxes = 0;
        int taxable_distribution;
        int total_saved = 0;
        int yearly_401k_contribution = 0;

        if (argc < 2) {
           printf("Missing input parameters to retire program.\n");
           printf("Usage: retire age_starting dollar_saved_per_month\n");
           exit(0);
        }

        age     = atoi(argv[1]);
        amount  =

        printf("\n");
        printf("Welcome to Your Retirement Calculator\n");
        printf("-----------------------------------------------------------------\n");
        printf("   1. You start saving at age %d.\n", age);
        printf("   2. The amount saved per month is $%d.\n", amount);
        printf("-----------------------------------------------------------------\n");

        for (i=age;i<65;i++) {
           yearly_401k_contribution = 12 * amount;
```

```c
        principle = principle + yearly_401k_contribution;

        // 6% of salary is matched at 50%.
        max_matching_401k_amount = SALARY * .06;

        if (yearly_401k_contribution >= max_matching_401k_amount)
           matching_401k_amount = 0;            // NEED TO CORRECT
        else
           matching_401k_amount = 0;            // NEED TO CORRECT

        // 1.107 is 10.7%, the average gain over 30 years in an S&P Index Fund.
        total_saved = (total_saved + (12 * amount)) * 1.107 + matching_401k_amount;

        printf("At age %d, principle = $%d, total saved = $%d\n",
                i, principle, total_saved);
     }

     printf("-------------------------------------------------------------------\n");
     printf("From age %d to 65, if $%d is saved per month:\n", age, amount);
     printf("    The principle amount you contributed is : $%d\n", principle);
     printf("    The principle amount + your gains is    : $%d\n", total_saved);
     printf("-------------------------------------------------------------------\n");

     printf("\n");
     printf("-------------------------------------------------------------------\n");
     printf("But how much money will I receive per year from 65 to 95?\n");
     printf("-------------------------------------------------------------------\n");

     before_tax_distribution = total_saved/(95-65);

// THE IF STATEMENTS BELOW ARE BASED ON OLD TAX TABLES.
// NEED TO UPDATE AND CORRECT FOR 2024 TAX TABLES.

     if (distribution <= 10275)
        taxes = distribution * 0.10;        // 10%
     else if (distribution <= 41775)
        taxes = 0;                          // 12%
     else if (distribution <= 89075)
        taxes = (10275*0.10) + (41775-10275)*.12 + (distribution-41775)*.22; // 22%
     else if (distribution <= 170050)
        taxes = 0;                          // 24%
     else if (distribution <= 215950)
        taxes = 0;                          // 32%
     else if (distribution <= 539900)
        taxes = 0;                          // 35%
     else
        taxes = 0;                          // 37%

     after_tax_distribution = before_tax_distribution - taxes;
     roth_distribution = ;

     printf("Distribution before taxes is: $%d\n",        before_tax_distribution);
     printf("Distribution from a 401k account is: $%d\n", after_tax_distribution);
     printf("Distribution from a ROTH account is: $%d\n", roth_distribution);
     printf("-------------------------------------------------------------------\n");
  }
```

To make life easier, we'll define all variables as integers.

Single Taxpayers

2025 Official Tax Brackets

If Taxable Income Is:	The Tax Due Is:
0 - $11,925	10% of taxable income
$11,926 - $48,475	$1,192.50 + 12% of the amount over $11,925
$48,476 - $103,350	$5,578.50 + 22% of the amount over $48,475
$103,351 - $197,300	$17,651 + 24% of the amount over $103,350
$197,301 - $250,525	$40,199 + 32% of the amount over $197,300
$250,526 - $626,350	$57,231 + 35% of the amount over $250,525
$626,351 and over	$188,769.75 + 37% of the amount over $626,350

Below are our assumptions. This is not financial advice.

1. You retire on your birthday at the age of 65.

2. You invest in an S&P 500 Index Fund which we'll assume earns 10.7% per year.

3. Over the past 30 years, the S&P 500 index has delivered a compound average annual growth rate of 10.7% per year.

4. Your employer matches 50% of your 401k contribution up to 6% of your salary.

5. Your employer does "End of Year" 401k Matching. (Not great for you as the employee.)

6. Your lifetime salary is $100,000/year and you never get a raise!

7. To reduce losing your money in retirement, you move the full amount saved on your birthday at the age of 65 into a money market account that earns 0% interest.

8. You receive the same distribution amount each year from 65 to 95 based on the total saved while working.

9. You stay single (so we only need to use single individual tax rates).

10. Since the amount in your 401k account is taxable, we will use the 2024 Tax Brackets for 30 years. We will ignore California state taxes that tax 9% of your salary.

Below is an example of running the retire program using **OLD** tax tables. 60 represents the person's age when they start to save money. The value of 100 is the amount saved per month (i.e., $100/mo).

% retire 60 100

```
Welcome to Your Retirement Calculator
-----------------------------------------------------------------
   1. You start saving at age 60.
   2. The amount saved per month is $100.
-----------------------------------------------------------------
At age 60, principle = $1200, total saved = $1928
At age 61, principle = $2400, total saved = $4062
At age 62, principle = $3600, total saved = $6425
At age 63, principle = $4800, total saved = $9040
At age 64, principle = $6000, total saved = $11935
-----------------------------------------------------------------
From age 60 to 65, if $100 is saved per month:
    The principle amount saved is  : $6000
    The principle + gains amount is: $11935
-----------------------------------------------------------------


-----------------------------------------------------------------
But how much money will I receive per year from 65 to 95?
-----------------------------------------------------------------
   Distribution before taxes is: $397
   Distribution if a 401k account is : $358
   Distribution if a ROTH account is : $ Need to figure out.
-----------------------------------------------------------------
```

To get full credit for Task 4, please run the retire program using the following commands.

% script 401k.txt

% retire 25 100

% retire 35 100

% retire 55 1000

% quit

Answer the following two questions:

Question 1.
If you delay your contributions into your 401k by 10 years (i.e., you start at age 35 instead of 25), how much less money do you save?

Question 2:
Using your retirement calculator, how much money do you need to contribute to reach $2.5 million dollars if you start at the age of 25?

During LAB 3, I'll explain how to turn in Tasks 1-5 for credit.