

Problem Set 10

1. What is the output of the following program?

```
#include <stdio.h>

int a = 1, b = 2;

int fun(int b) {
    ++a;
    ++b;
    printf("a=%d, b=%d\n", a, b);
}

int main() {
    int a = 3;
    fun(a);
    printf("a=%d, b=%d\n", a, b);
}
```

2. Convert problem 1 of Problem Set 7 to the one using functions.

3. Write functions to do the following:

- return 1 if number n is prime
- return n^{th} fibonacci number
- return n^{th} power of 2
- return n^{th} prime number
- return the sum of all digits of n
- return a random number less than n

4. Write a function to take two integers $n1$ and $n2$ as arguments and:

- return $n1 * n2$
- return $n1^{n2}$
- return 1 if $n1 < n2$ else 0
- return Ackermann($n1, n2$)
- return if $n1$ and $n2$ are co-primes

5. Read n rectangle dimensions (length and breadth) from user. A rectangle can fit inside another, if its dimensions are strictly less than the other's. For instance, a rectangle 2×3 can fit into 4×3 , as $2 < 3$ and $3 < 4$. Find the largest fitting of rectangles (that is, $n1$ fits into $n2$ which fits into $n4$ which fits into $n10$, etc.).

6. Solve 8-queens problem. You need to place eight queens in an 8×8 matrix such that no queen attacks any other queen. Two queens attack if they are in the same row or column or diagonal. For instance, one solution is given below. Can you print all solutions?

Q							
				Q			
	Q						
					Q		
		Q					
						Q	
			Q				
							Q

7. Without using decimal-to-binary conversion, print all binary numbers of length 5. Print them with leading zeros first, and later try to remove the leading zeros.
8. Given two sets S1 and S2 of integers, find if S1 is a subset of S2, or S2 is a subset of S1, or they are equal or they are non-comparable.
9. Given a Sudoku problem, solve it. First, in a naive manner, then apply optimizations.
10. For those of you who know the puzzle on grass-goal-tiger with a man wanting to cross a river in a boat with carrying-capacity two, model the puzzle as a programming problem and see if you can generate solutions by executing your C program.