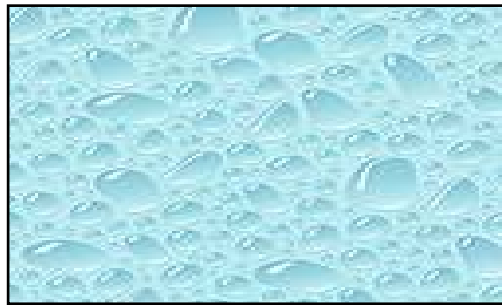


## Exercise 1: Tray and slabs (50 marks)

There are 2 sub-tasks in this exercise.

**First subtask:** As in lab #1, you are given a rectangular tray and an unlimited supply of slabs. An example of a  $12 \times 20$  tray and an  $8 \times 3$  slab is shown below. Note that it is possible for the slab to be larger than the tray.

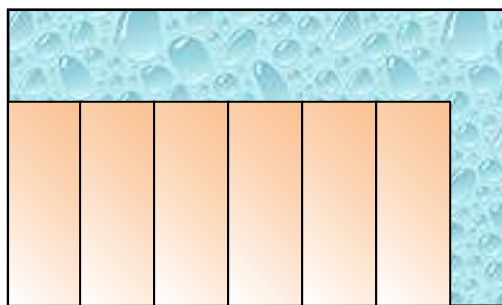


A  $12 \times 20$  tray

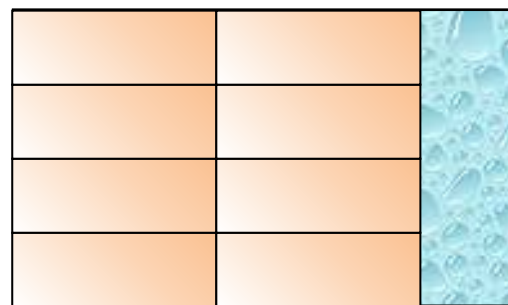


An  $8 \times 3$  slab

You are to find the minimum unused area of the tray after the slabs are packed onto the tray. The slabs may be packed in either one of the two orientations, as shown below, but not in a mix of orientations.



Unused area of tray = 96

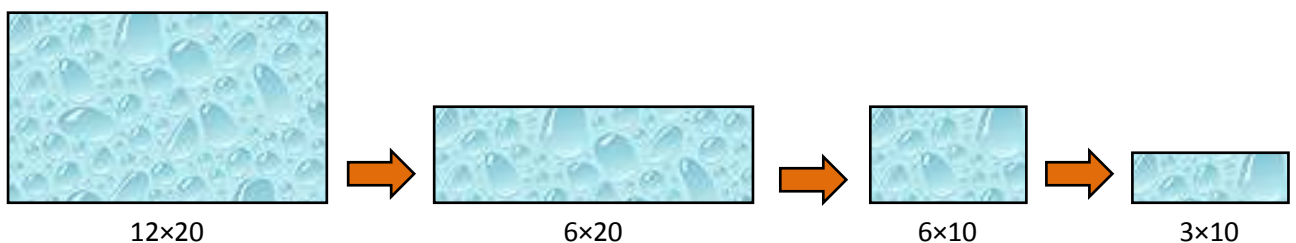


Unused area of tray = 48

The minimum unused area of the tray is 48 in this example.

**Second subtask:** The tray is made of foldable material. Supposed you are to fold the tray in half three times, each time either horizontally or vertically. Compute the minimum perimeter of the tray after the folding.

Below is one way of folding the tray. The tray has been resized in the drawing to conserve space. In the example below, the perimeter of the tray after folding is 26, but this is not the minimum perimeter possible. The minimum perimeter is 22.



Write a program **tray.c** to read in the sizes of the tray and slab, which must be of **int** type. Your program then computes the following:

1. The minimum unused area of the tray after it is filled with slabs. The slabs can be filled in one of the two orientations. Your program should have a function **min\_unused\_area()** for this. You are to determine its return type and parameters.
2. The minimum perimeter of the tray after it is folded in half 3 times. Your program should have a function **min\_perimeter()** for this. You are to determine its return type and parameters.

If you do not have the functions **min\_unused\_area()** and **min\_perimeter()** in your program, marks will be deducted on design. You may write additional function(s) if you think it is necessary.

Two sample runs are shown below, with user input shown in **bold**. Note that the perimeter is printed in 2 decimal places.

```
Enter size of tray: 12 20
Enter size of slab: 8 3
Minimum unused area = 48
Minimum perimeter after folding = 22.00
```

```
Enter size of tray: 12345 139
Enter size of slab: 27 33
Minimum unused area = 49785
Minimum perimeter after folding = 3364.25
```

### **Skeleton Program:**

A skeleton program **tray.c** is available in your plab account and is shown below.

```
// CS1010 AY2013/4 Semester 1
// PE1 Ex1: tray.c
// Name:
// Matriculation number:
// plab-id:
// Discussion group:
// Description:

int main(void) {
    int trayHeight, trayWidth, slabHeight, slabWidth;

    printf("Enter size of tray: ");
    printf("Enter size of slab: ");
    printf("Minimum unused area = "); // incomplete
    printf("Minimum perimeter after folding = "); // incomplete
    return 0;
}
```