

CIS 121-217—Homework 17

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Problem 1

Since f is continuous on the closed interval $[a, b]$, by the Extreme Value Theorem, the function f takes on a maximum value M and a minimum value N on $[a, b]$. Then

$$(b - a)N \leq \int_a^b f(x) \, dx \leq (b - a)M$$

so

$$N \leq \frac{1}{b - a} \int_a^b f(x) \, dx \leq M$$

By the Intermediate Value Theorem, there must exist a value of c with $a \leq c \leq b$ such that

$$f(c) = \frac{1}{b - a} \int_a^b f(x) \, dx. \quad (1)$$

Note: I can make a reference to a labeled thing like equation (??) with `\eqref`, or I can do it like with `\autoref` to get ???. Here's a QED tombstone to mark the end of my solution. \square

Problem 2

I can reference another problem like this: See ?? or ??.

Problem 3

3 a

The Ackermann function is

$$A(m, n) := \begin{cases} n + 1 & \text{if } m = 0 \\ A(m - 1, 1) & \text{if } m > 0 \text{ and } n = 0 \\ A(m - 1, A(m, n - 1)) & \text{if } m > 0 \text{ and } n > 0 \end{cases} \quad \square$$

3 b

This is how you do an aligned equation environment:

$$\begin{aligned} d(f, h) &= \int_a^b |f(x) - h(x)| \, dx \\ &= \int_a^b |f(x) - g(x) + g(x) - h(x)| \, dx \\ &\leq \int_a^b (|f(x) - g(x)| + |g(x) - h(x)|) \, dx \\ &= \int_a^b |f(x) - g(x)| \, dx + \int_a^b |g(x) - h(x)| \, dx \\ &= d([f], [g]) + d([g], [h]) \end{aligned} \quad \square$$

or you can do this to suppress numberings for specific lines

$$\begin{aligned}d(f, h) &= \int_a^b |f(x) - h(x)| \, dx \\&= \int_a^b |f(x) - g(x) + g(x) - h(x)| \, dx \\&\leq \int_a^b (|f(x) - g(x)| + |g(x) - h(x)|) \, dx \\&= \int_a^b |f(x) - g(x)| \, dx + \int_a^b |g(x) - h(x)| \, dx \\&= d([f], [g]) + d([g], [h])\end{aligned}\tag{2}$$

so you can have a reference to just (??). □

Problem 4

4 a

Follow this link to find out more about source code formatting.

```
for (int n : new int [] {17, 34, 51, 68, 85}) {
    System.out.println(n);
}
```