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

\[
f(c) = \frac{1}{b - a} \int_a^b f(x) \, dx. \tag{1}
\]

Note: I can make a reference to a labeled thing like equation \([1]\) with \texttt{\eqref}, or I can do it like with \texttt{\autoref} to get Equation 1. Here’s a \texttt{QED} tombstone to mark the end of my solution.

Problem 2

I can reference another problem like this: See Problem 3 b or Problem 1.

Problem 3

3 a

The Ackermann function is

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

3 b

This is how you do an aligned equation environment:

\[
d(f, h) = \int_a^b |f(x) - h(x)| \, dx
\]

\[
= \int_a^b |f(x) - g(x) + g(x) - h(x)| \, dx
\]

\[
\leq \int_a^b (|f(x) - g(x)| + |g(x) - h(x)|) \, dx
\]

\[
= \int_a^b |f(x) - g(x)| \, dx + \int_a^b |g(x) - h(x)| \, dx
\]

\[
= d([f], [g]) + d([g], [h])
\]

\[
\text{QED}
\]
or you can do this to suppress numberings for specific lines

\[
d(f, h) = \int_{a}^{b} |f(x) - h(x)| \, dx \\
= \int_{a}^{b} |f(x) - g(x) + g(x) - h(x)| \, dx \\
\leq \int_{a}^{b} (|f(x) - g(x)| + |g(x) - h(x)|) \, dx \\
= \int_{a}^{b} |f(x) - g(x)| \, dx + \int_{a}^{b} |g(x) - h(x)| \, dx \\
= d([f], [g]) + d([g], [h])
\] (2)
so you can have a reference to just (2).

Problem 4

4 a

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

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