CS Assignment 4 - Part 1
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5.2
9)

5.2

9) $n = 3$ $\quad 4^3 = 64 = 4\frac{4^3 - 16}{3}$

result holds for some integer $k \geq 3$

$$4^3 + \dots + 4^{k+1} = 4\frac{4^k - 16}{3} + 4^{k+1}$$

$$= 4\frac{4^k - 16 + 3 * 4^k}{3} = \frac{4 * 4^k - 16}{3}$$

$$= \frac{4^{k+1} - 16}{3}$$ Result by induction.

5.3
10)

$$= \frac{4^{k+1} - 16}{3}$$ Result by induction.

5.3

10) $n^3 - 7n + 3$ is divisible by 3, each integer $n \geq 0$

For $n = 0$, $(0)^3 - 7(0) + 3$ which is divisible by 3

For $n = 0$ the statement is true.

Let k be any integer $k \geq 0$ and suppose that

$k^3 - 7k + 3$ is divisible by 3.

this means that $k^3 - 7k + 3 = 3r$ for some int r.

$(k+1)^3 - 7(k+1) + 3$ is divisible by 3.

$$= k^3 + 3k^2 - 4k - 3$$
$$= (k^3 - 7k + 3) + 3k^2 + 3k - 6$$
$$= 3k^2 + 3k - 6 + 3r$$
$$= 3(k^2 + k - 2 + r)$$

But $k^2 + k - 2 + r$ is an int b/c it's the sum of products of integers.

$(k+1)^3 - 7(k+1) + 3$ is divisible by 3

Problem is true

18)

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18) $n = 2$ | $5^2 + 9 = 34$ | $6^2 = 36$ } True

$n = k$

$5^k + 9 < 6^k$

$n = k + 1$

$5^{k+1} + 9 < 6^{k+1}$

$5^{k+1} + 9 = 5(5^k + 9) - 36 < 6^k - 36$

$6k < 6^{k+1} = 6^k - 36 < 6^{k+1} - 36 < 6^{k+1}$

$= 5^{k+1} + 9 < 6^{k+1}$ Proposition is true.

23.b)

23. b) ~~[illegible]~~ $n! > n^2$, for all int $n \geq 4$

$(k+1)! = k!(k+1)$

$> k^2(k+1)$ → assumption

$> (k+1)(k+1)$

since $k^2 > k + 1$ for $k \geq 4$

$n! > n^2$ for all $n \geq 4$

Set 5, 4

Set 5.4
2)

Set 5, 4

2) Let $P(n) = b_n$ is divisible by 4

1. Anchor

$b_1 = 4$ and $b_2 = 12$ (both divisible by 4)

Property is valid for $n = 1$ and $n = 2$.

2. induction

$k > 2$, the property is valid for all integers i such that $1 \leq i < k$, then if it is valid for $n = k$, the statement is proved.

3. Inductive hypothesis

Let $k > 2$ be an int

b_i is divisible 4 for all integers i such that $1 \leq i < k$

If b_k is divisible by 4, we will have proven the statement.

$b_k = b_{k-2} + b_{k-1}$

$k > 2$, $0 < k - 2 < k$, $1 < k - 1 < k$

both b_{k-2} and b_{k-1} are divisible by 4.

There exists integer A and B such that $b_{k-2} = 4A$, and $b_{k-1} = 4B$.

$b_k = b_{k-2} + b_{k-1} = 4A + 4B = 4(A + B)$

$b_k = 4(A+B)$ is divisible by 4.

~~P(14) is true b/c 14¢ can be obtained~~

10)

10) P(14) is true b/c 14¢ can be obtained with 3(3¢) and 1(5¢).
(9¢ + 5¢ = 14)

P(15) is true b/c it can be obtained by 5(3¢) = 15¢

P(16) is true b/c ... 2(3¢) and 2(5¢). (6¢ + 10¢ = 16¢)

P(17) is true as a consequence of P(14) being true)

P(18) is true as a consequence of P(15) being true.

P(19) is true as a consequence of P(16) being true.

P(14), (15), 16) PROVES $n \geq 14$ for P(n).