CS 173, Spring 2016
Examlet 8, Part B

NETID:	

FIRST:	LAST:

Discussion: Monday 9 10 11 12 1 2 3 4 5

(10 points) Suppose we have a function F defined (for n a power of 2) by

$$\begin{aligned} F(2) &= 17 \\ F(n) &= 3F(n/2), \text{ for } n \geq 4 \end{aligned}$$

Use unrolling to find the closed form for F. Show your work and simplify your answer.

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1. (8 points) Suppose we have a function g defined by

$$\begin{aligned} g(0) &= g(1) = c \\ g(n) &= kg(n-2) + n^2, \text{ for } n \geq 2 \end{aligned}$$

where k and c are constants. Express $g(n)$ in terms of $g(n-6)$ (where $n \geq 6$). Show your work and simplify your answer.

2. (2 points) Check the (single) box that best characterizes each item.

Shorthand for the n-dimensional hypercube.

C_n ☐ H_n ☐ Z_n ☐ Q_n ☐

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1. (8 points) Suppose we have a function f defined by

$$\begin{aligned} f(1) &= 5 \\ f(n) &= 3f(n-1) + n^2 \text{ for } n \geq 2 \end{aligned}$$

Express $f(n)$ in terms of $f(n-3)$ (where $n \geq 4$). Show your work and simplify your answer.

2. (2 points) Suppose that $f : \mathbb{N} \to \mathbb{N}$ is such that $f(n) = n^2$. Give a recursive definition of f

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(10 points) Suppose we have a function f defined by

$$\begin{aligned} f(0) &= f(1) = 3 \\ f(n) &= 5f(n-2) + d, \text{ for } n \geq 2 \end{aligned}$$

where d is a constant.

Your partner has already figured out that

$$f(n) = 5^k f(n-2k) + \sum_{p=0}^{k-1} d5^p$$

Finish finding the closed form for $f(n)$ assuming that n is even. Show your work and simplify your answer. Recall the following useful closed form (for $r \neq 1$): $\sum_{k=0}^{n} r^k = \frac{r^{n+1}-1}{r-1}$

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1. (8 points) Suppose we have a function f defined by

$$\begin{aligned} f(0) &= f(1) = 3 \\ f(n) &= 5f(n-2) + d, \text{ for } n \geq 2 \end{aligned}$$

where d is a constant. Express $f(n)$ in terms of $f(n-6)$ (where $n \geq 6$). Show your work and simplify your answer.

2. (2 points) Check the (single) box that best characterizes each item.

$f(n) = n!$ can be defined recursively by $f(0) = 1$, and $f(n) = nf(n-1)$ for all integers ...

$n \geq 0$ ☐ $n \geq 1$ ☐ $n \geq 2$ ☐

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(10 points) Suppose we have a function g defined (for n a power of 4) by

$$\begin{aligned} g(1) &= c \\ g(n) &= 4g(n/2) + n \text{ for } n \geq 4 \end{aligned}$$

Your partner has already figured out that

$$g(n) = 4^k g(n/2^k) + n \sum_{p=0}^{k-1} 2^p$$

Finish finding the closed form for $g(n)$ assuming that n is a power of 2. Show your work and simplify your answer. Recall that $\log_b n = (\log_a n)(\log_b a)$.