

# Worksheet #10: Associativity and Commutativity

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Name: \_\_\_\_\_

Netid: \_\_\_\_\_

A Finish Accumulator (FA) can be used with any *associative and commutative* binary function. The Parallel Prefix Sum (PPS) algorithm can be used with any *associative* binary function

A binary function  $f$  is *associative* if  $f(f(x,y),z) = f(x,f(y,z))$ .

A binary function  $f$  is *commutative* if  $f(x,y) = f(y,x)$ .

For each of the following functions, indicate if it can be used in a Finish Accumulator (FA) or a Parallel Prefix Sum (PPS) algorithm or both or neither.

1)  $f(x,y) = x+y$ , for integers  $x, y$

2)  $g(x,y) = (x+y)/2$ , for integers  $x, y$

3)  $h(s1,s2) = \text{concat}(s1, s2)$  for strings  $s1, s2$ , e.g.,  $h(\text{"ab"}, \text{"cd"}) = \text{"abcd"}$

