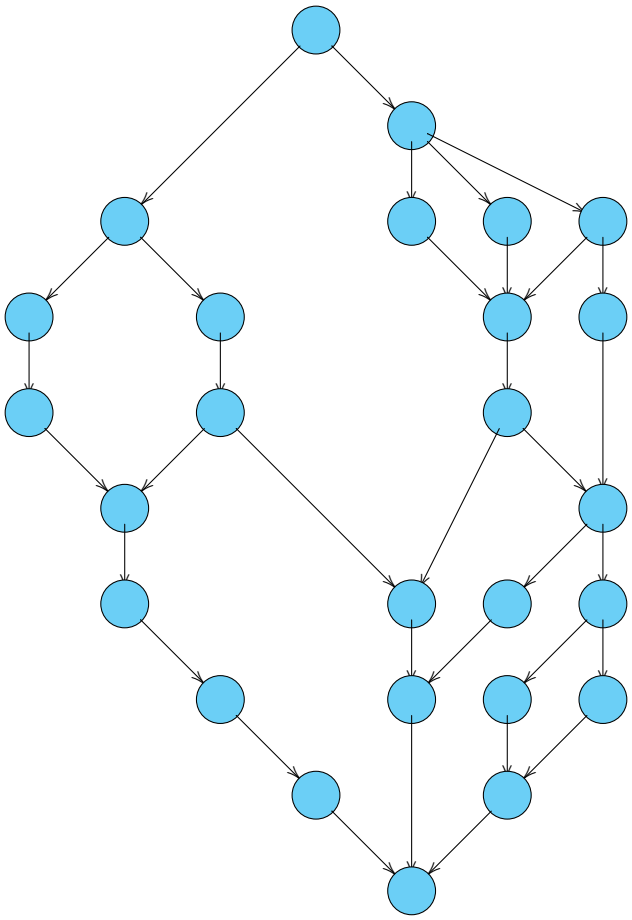
Consider the following dag representing a multithreaded computation, where each circle denotes a serially executing strand that takes unit time to execute:



Please provide a numerical answer to the following questions.

- What is the work of this computation?
- What is the span of this computation?
- What is the parallelism of this computation?

Five students have implemented recursive Fibonacci programs, where the base case of each program returns 1 if the program input is `n = 0` or `n = 1`. For `n > 1`, the various students calculate Fibonacci using the code snippets for the recursive cases shown below:

a:
```
x = fib(n - 1);
y = fib(n - 2);
```

b:
```
x = cilk_spawn fib(n - 1);
y = cilk_spawn fib(n - 2);
cilk_sync;
```

c:
```
x = fib(n - 1);
y = cilk_spawn fib(n - 2);
cilk_sync;
```

d:
```
y = cilk_spawn fib(n - 2);
x = fib(n - 1);
cilk_sync;
```

e:
```
x = cilk_spawn fib(n - 1);
y = fib(n - 2);
cilk_sync;
```

Assume that the overhead of spawning a function is about 10 times the cost of an ordinary function call. Rank these codes in order of the performance you would expect for large n. (e.g., fastest $>$ second fastest $> \cdots >$ slowest):

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6.172 Performance Engineering of Software Systems

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