Prereq Quiz. 170 Fall 2013.

Submit your prereq quiz to glookup under the assignment name prereq. The grade for this quiz is based on submitting a good faith effort. That is, the last question should be answered yes.

You are welcome to brush up a bit or answer it cold. The second to last question asks you to indicate the which you did.

The format should be
1. A (or B or C)
2. 2/3 (or the correct fraction...)
3.
.

The prereq quiz will be autograded, the success or failure of the autograder to parse it will affect your participation points. We will provide an autoparser prior to submission, so you can check.

1. How many 5 card hands (poker hands) are there? (52 card deck.)

   (a) $52 * 51 * 50 * 49 * 48$

   (b) $52 * 51 * 50 * 49 * 48/5$

   (c) $52 * 51 * 50 * 49 * 48/5!$

2. If you have have been dealt 4 hearts, what is the chance your fifth card will be a heart? (Your answer should be written as a rational number: a/b.)

3. If you have have been dealt 3 hearts, what is the chance your last two cards will be hearts? (Your answer should be written as a rational number: a/b.)

4. How big is $\{a \in [0, \ldots, 10] : a \text{ is even.}\}$?

   (a) 11

   (b) 10

   (c) 5

   (d) 6

   (e) 7

5. Which of the following is $\Theta(n^2)$?

   (a) $5n^2 + 4n + 5$

   (b) $5n + 4/n + 6$

   (c) $6n^3 + 4n + 4$

6. Which asymptotic notation properly bounds the run time of the following piece of code?

```
def fib(n):
  if n == 0 or n == 1:
    return 1
  else
    return fib(n-1)+fib(n-2)
```

   (a) $O(n^2)$

   (b) $O(2^n)$

   (c) $O(n)$

7. In asymptotic notation, assuming that python uses 2-universal hashing, the expected runtime for dictionary lookup in a dictionary that contains n items is bounded best by

   (a) $\Theta(n)$

   (b) $O(\log n)$

   (c) $O(1)$.

8. Which asymptotic notation most accurately bounds the expected runtime of an execution of the code below for an input N.

```
remember_the_fib = {}
# this is a dictionary

def fib(n):
  if n in remember_the_fib:
    return remember_the_fib[n]
  if n == 0 or n == 1:
    return 1
  else
    remember_the_fib[n] =  fib(n-1)+fib(n-2)
    return remember_the_fib[n]
```

   (a) $O(n^2)$
   (b) $O(2^n)$
   (c) $O(n)$

9. Consider an undirected graph on 5 nodes, where the adjacency lists are

```
Vertex 0: 1
Vertex 1: 0,2,4
Vertex 2: 1,3
Vertex 3: 2,4
Vertex 4: 1,3
```

   What is the order of the nodes visited using depth first search starting at node 0? (Assume the edges are explored according to their order in the adjacency lists.)

   (a) 0,1,2,3,4
   (b) 0,1,4,3,2

10. For the graph in the previous question what ordering could occur in a breadth first search?

    (a) 0,1,2,3,4
    (b) 0,1,2,4,3

11. In an $n \times m$ maze (n rows and m columns), how many shortest paths go from the lower left corner to the top right corner.

    (a) nm
    (b) $\binom{n}{m}$
    (c) n^m
    (d) $\binom{n+m-2}{n-1}$
    (e) $\binom{n+m-1}{n}$

12. What is the multiplicative inverse of 5 in modular arithmetic base 12?

    (a) 11
    (b) .2
    (c) 5
    (d) 1

13. Give the solution to the following system of equations using modular arithmic modulo 5?

$$\begin{aligned} 4x + 3y &\equiv 0 \pmod 5 \\ 2x + y &\equiv 3 \pmod 5 \end{aligned}$$

14. How many distinct degree 5 polynomials are there over the modular arithmeic modolo 5?

    (a) Infinite.
    (b) Uncountably infinite.
    (c) A specific number, include it in your answer. (A valid line in your submission file is "14. C. 3".)

15. Which step is wrong in the following proof.

    $x = y$ implies that $ax = ay$ for all a
    $3(0) = 4(0)$
    which with line 1 implies that $3 = 4$.

    (a) line 1
    (b) line 2
    (c) line 3
    (d) none

16. The statement $P(0) \wedge (P(k) \rightarrow P(k+1)) \implies \forall k \in N, P(k)$, is commonly referred to as

    (a) the principle of induction,
    (b) the axiom of choice,
    (c) the Riemann hypothesis.

17. Consider the following proof of a well known inequality.
    Thm: $\sum_{i=1}^{n} i = \frac{(n)(n+1)}{2}$ for all $n \geq 1$

    Proof by induction:
    Base Case: $P(1)$ is true since $\sum_{i=1}^{1} = 1 = (1)(2)/2$.

$$\begin{aligned}
\sum_{i=1}^{n} i &= \sum_{i=1}^{n-1} i + n && (1)\\
&= \frac{(n-1)(n)}{2} + n && (2)\\
&= \frac{n^2 - n + 2n}{2} && (3)\\
&= \frac{n^2 + n}{2} && (4)\\
&= \frac{(n)(n+1)}{2} && (5)\\
& && (6)
\end{aligned}$$

    In which line do you use the induction hypothesis?

18. What did you do to take this quiz?

    (a) Took it cold.

    (b) Brushed up a bit.

    (c) Serious brushing up.

19. Did you make an honest effort on this quiz?

    (a) Yes.

    (b) No.

20. When did you take CS70 (or alternative prereq)? (Example Answers: Spring 2012, Summer 2011 (MATH55), Fall 2010).