

Name: _____

Biology 3820
Physical Principles in Biology
Spring Semester 2011

Quiz 1
28 January 2011

Please write your name on each page.

Be sure to show your work and include correct units in all of your answers!

25 points total.

1. (6 pts) A typical yeast cell is roughly spherical and has a radius of about $5\ \mu\text{m}$. The nucleus of a yeast cell is also roughly spherical, with a radius of about $2\ \mu\text{m}$.

(a) What is the volume of a typical yeast cell? Express your answer in both μm^3 and m^3 .

(b) What fraction of the total cell volume does the nucleus occupy? (There's a hard way and an easy way to do this!)

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2. (12 pts) Suppose that you and a friend are playing a game in which one of you tosses a coin three times in succession, and the result of the game is defined in terms of the number of times the coin lands heads-up.

(a) Define the sample set for one round of the game, i.e., all of the possible outcomes defined in terms of the sequence of heads (H) and tails (T).

(b) Define a set of four events, E_0 , E_1 , E_2 and E_3 , where the subscript represents the number of heads. Calculate the probability of each of these events, assuming the coin is fair.

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- (c) Unbeknownst to you, your “friend” is using a fixed coin, for which the probability of landing heads-up is 0.6. Recalculate the probabilities for the events E_0 , E_1 , E_2 and E_3 .

- (d) Secure in her knowledge that heads are more likely than tails, your friend offers the following bet: If the number of heads is 2, you pay her \$1; if the number is 0, 1 or 3, she will pay you \$1. Is this a good bet for her? Explain your reasoning.

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3. (7 pts) Someone has left the following bit of Python code on a computer, with a provocative note: “This function contains the secret of life!”

```
def fib(n):  
    i = 0  
    j = 1  
    print i  
    print j  
    for x in range(n-2):  
        k = i+j  
        print k  
        i = j  
        j = k
```

- (a) You must act as the Python interpreter. Write out the output expected for executing `fib(5)`.

- (b) Explain briefly in words how the resulting numbers are related to each other.

- (c) For an extra gold star, what is this sequence of numbers called?