

Suffolk County Community College  
Michael J. Grant Campus  
Department of Mathematics

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Spring 2025

**MAT 106**  
**Mathematics for Health Science**

**Final Exam**

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**Instructor:**

Name: Alexander Kasiukov  
Office: Suffolk Federal Credit Union Arena, Room A-109  
Phone: (631) 851-6484  
Email: kasiuka@sunysuffolk.edu  
Web Site: <http://kasiukov.com>

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*Please print the requested information in the spaces provided:*

**Student:**

Name:

Student Id:

Email:

include to receive the final grade via email ONLY if you are not getting email updates

- *Notes and books are permitted on this exam.*
- *Graphing calculators, smartwatches, computers, cell phones and any other communication-capable devices are prohibited. Their mere presence in the open (even without use) is a sufficient reason for an immediate dismissal from this exam with a failing grade.*
- *You will not receive full credit if there is no work shown, even if you have the right answer. Please don't attach additional pieces of paper: if you run out of space, please ask for another blank final.*

**Problem 1.** Midazolam hydrochloride is available in a bottle with the following label:



(1). What weight of the pure drug is contained in the whole bottle?

*Space for your solution:*

(2). Determine the needed dose of the medication, if 15 mg of the drug is ordered.

*Space for your solution:*

(3). How many full doses (as computed in the previous sub-problem) are contained in this bottle?

*Space for your solution:*

**Problem 2.** This problem will introduce you to the *Simpson's Paradox*.

1314 women took part in a study <sup>1</sup> of thyroid disease that was conducted in 1972-1974 in Newcastle, United Kingdom. A follow-up study of the same subjects <sup>2</sup> took place nearly thirty years later.

(1). The subjects of the study were classified according to their smoking habits (current smokers at the time of the original 1970's study or those who never smoked) and according to their survival status 20 years after the original study. The outcomes are summarized in the following table:

	Smoker	Non-smoker
Dead	139	230
Alive	443	502

Based on this table, determine if smoking has positive or negative effect on survival.

Hint: compute and compare the conditional probabilities:

$$P(\text{Alive}|\text{Smoker})$$

$$P(\text{Alive}|\text{Non-smoker})$$

*Space for your solution:*

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<sup>1</sup>W. M. G. Tunbridge, D. C. Evered, D. Appleton, M. Brewis, F. Clark  
"The Spectrum of Thyroid Disease in a Community: The Wickham Survey",  
Clinical Endocrinology, Volume 7, Issue 6, December 1977, Pages 481-493  
<http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2265.1977.tb01340.x/abstract>

<sup>2</sup>David R. Appleton, Joyce M. French and Mark P. J. Vanderpump  
"Ignoring a Covariate: An Example of Simpson's Paradox",  
The American Statistician, Volume 50, Number 4, November 1996, Pages 340-341  
[http://www.jstor.org/stable/2684931?seq=1#page\\_scan\\_tab\\_contents](http://www.jstor.org/stable/2684931?seq=1#page_scan_tab_contents)

(2). The subjects were further classified according to their age at the time of the original study. The outcomes for women aged 18 to 64 are summarized in this table:

Age 18 to 64	Smoker	Non-smoker
Dead	97	65
Alive	436	474

Determine if smoking has positive effect on survival of women in this age group.

*Space for your solution:*

(3). The outcomes for women aged 65 and above are summarized in this table:

Age 65 and above	Smoker	Non-smoker
Dead	42	165
Alive	7	28

Determine if smoking has positive effect on survival of women in this age group.

*Space for your solution:*

(4). What conclusion can you draw from this consideration: does smoking improve or harm survival chances? If smoking is beneficial, why it is not shown by the analysis of age groups? If smoking is harmful, why does it contradict the outcome for the combined analysis (that ignores age)?

*Space for your solution:*

**Problem 3.** The sensation of taste is a combination of five basic tastes: sweet, bitter, sour, salty, and glutamic (called *umami* by Japanese). Synthetic compound phenylthiocarbamide (PTC) is used to study the genetics of bitter perception. PTC tastes very bitter to most persons. The inability to taste PTC is controlled by a single autosomal recessive gene, called TAS2R38. In the white American population, about 70% can taste PTC, while 30% cannot (are non-tasters). Assume that the white American population is in the state of Hardy-Weinberg equilibrium with respect to the taster (T) and nontaster (t) alleles. The taster trait is dominant and non-taster — recessive.

(1). Find the frequency of the of the taster (T) and nontaster (t) alleles in the white American population.

*Space for your solution:*

(2). Find the probability of each TAS2R38 genotype in the white American population.

*Space for your solution:*

**(3).** Find the probability that one taster and one non-taster white American parent give birth to a taster child.

*Space for your solution:*