GEBS524 homework #2

Due 1/26 before class

1. Suppose an influenza epidemic strikes a city. In 10% of families the mother has influenza; In 10% of families the father has influenza; in 2% of families both the mother and father have influenza.
2. Are the events A1={mother has influenza} and A2={father has influenza} independent?
3. What is the conditional probability that the father has influenza given that the mother has influenza?
4. What is the probability that the family will have influenza?
5. Suppose there are two children in this family, and there is a 20% each child will get influenza, and 10% of chance both child will get the disease. What is the probability that at least one child will get influenza?
6. Estimates of the prevalence of Alzheimer’s disease have recently been provided. The estimates are given in the following table. Suppose an unrelated 77-year-old man, 76-year-old woman, and 82-year-old woman are selected from a community.

|  |  |  |
| --- | --- | --- |
| Age group | Males | Females |
| 65-69 | 1.6 | 0 |
| 70-74 | 0 | 2.2 |
| 75-79 | 4.9 | 2.3 |
| 80-84 | 8.6 | 7.8 |
| 85+ | 35 | 27.9 |

1. What is the probability that all three of these individuals have Alzheimer’s disease?
2. For two women, what is the probability that at least one of woman have Alzheimer’s disease?
3. For two women, what is the probability that exactly one of woman have Alzheimer’s disease?
4. Suppose the rate of type II diabetes mellitus (DM) in 40-59 years old is 7% in Caucasians, 10% among African-Americans, 12% among Hispanics and 5% among Asian-Americans. Suppose the ethnic distribution in Houston, Texas among 40-59 years old is 30% Caucasian, 25% African-American, 40% Hispanic and 5% Asian-American. What is the overall probability of type II DM among 40-59 years old Houston?

(Hint: Use generalized multiplication Law of probability. P(B)=P(B|A1) x P(A1) + P(B|A2) x P(A2) + P(B|A3) x PrA3) + P(B|A4) x PrA4) )

1. The Mini-Mental Status Test (CMMS) consists of 114 items intended to identify people with Alzheimer’s disease and senile dementia among people. An extensive clinical evaluation of this instrument was performed, whereby participants were interviewed by psychiatrists and nurses and a definitive diagnosis of dementia was made. The following table showed the results obtained for the subgroup of people with at least some formal education.

|  |  |  |
| --- | --- | --- |
| CMMS score | Nondemented | Demented |
| 0-5 | 0 | 2 |
| 6-10 | 0 | 1 |
| 11-15 | 3 | 4 |
| 16-20 | 9 | 5 |
| 21-25 | 16 | 3 |
| 26-30 | 18 | 1 |
| Total | 46 | 16 |

1. Suppose a cut-off value of ≤20 on the test is used to identify people with dementia. What is the sensitivity and specificity?
2. Suppose we consider changing the cutoff. What are the sensitivity and specificity if cutoffs of 5, 10, 15, 20, 25, or 30 are used? Make a table of your results.
3. Construct an ROC curve based on the table you constructed.