Introduction to the Scientific Basis of Medicine

Sample examination questions

Examination
The examination will take the form of a 45 minute paper with multiple choice questions only. Examples of the kinds of questions that will be asked are shown below.

Sample Questions
*For each question indicate the single best answer out of the five possible options.*

1. In a study, over a period of two months, 5 out of 100 men aged 30-35 years old reported having migraine headaches. Over a period of four months, 20 of 100 women aged 30-35 years old reported having migraine headaches. In this study, the relative risk of women developing headaches compared to men was

   (a) 20
   (b) 5
   (c) 4
   (d) 2
   (e) 0.5

2. A new serological test has been developed for diagnosis of bovine paratuberculosis. This test was used on 200 dairy cattle known to be infected with bovine paratuberculosis based on isolation of Mycobacterium paratuberculosis from fecal samples, and 300 dairy cattle designated free of disease. Among the 200 dairy cattle known to be infected with bovine paratuberculosis, 120 had a positive test and 80 had a negative test. Among the 300 dairy cattle designated free of bovine tuberculosis, 30 had a positive test and 270 had a negative test.

   The sensitivity of the serological test for detecting bovine paratuberculosis is

   (a) 90%
   (b) 80%
   (c) 60%
   (d) 40%
   (e) 10%

3. The major purpose of random assignment in a clinical trial is to:

   (a) Help ensure that study subjects are representative of the general population
   (b) Help ensure double blinding
   (c) Help ensure that the study groups are comparable on baseline characteristics
   (d) Facilitate adherence to the intervention
   (e) Facilitate measurement of the outcome variables

4. A case control study is characterised by all the following except:
(a) It is relatively inexpensive compared with most other epidemiologic study designs
(b) Cases with the disease are compared to controls without the disease
(c) Incidence rates may be computed directly
(d) Assessment of past exposure may be biased
(e) Definition of cases may be difficult

5. A study to test the hypothesis that volcanic dust causes silicosis is to be tested by comparing the population of an island very close to a volcanic eruption with the population of an island not so exposed. After 5 and 10 years the incidence of silicosis will be measured and compared in both populations. This study is

(a) a cross sectional study
(b) a case control study
(c) a prospective study
(d) a randomised controlled trial
(e) a sequential trial

6. A clear pictorial representation of the number of 10 different types of operation performed by a hospital in a year is required. What type of graph should be used?

(a) Bar chart.
(b) Scatterplot.
(c) Boxplot.
(d) Pie chart.
(e) Cumulative frequency graph.

7. Suppose that 16 people are selected at random from the general population. Their body-mass-index (BMI) is evaluated. The mean BMI was 25.6 kg/m² with standard deviation 2.7 kg/m². The 95% confidence interval for mean BMI in the population is therefore calculated as

(a) $25.6 \pm 1.96 + \frac{2.7^2}{\sqrt{16}}$
(b) $25.6 \pm t_{15} \times \frac{2.7}{4}$
(c) $25.6 \pm t_{15} \times 2.7$
(d) $25.6 \pm 1.96 \times \frac{2.7}{\sqrt{16}}$
(e) $25.6 \pm 1.96 \times 2.7$

Note: Here, 1.96 is the value of the standard normal distribution corresponding to a two-sided p-value of 0.05. $t_{15}$ represents the value of the t-distribution on 15 degrees of freedom corresponding to a two-sided p-value of 0.05.

8. The figure below gives boxplots for the weights of a sample of 10-year-old boys and girls. Which one of the following conclusions can be drawn using this chart?

(a) Around 50% of boys weighed between 34 and 45 kg.
(b) 50% of girls weighed at least 39 kg.
(c) The mean weight for girls was 39 kg.
(d) The range of weights for boys was approximately 39 to 44 kg.
(e) The maximum weight for boys was 50 kg.

9. Which is a true statement about hypothesis tests for categorical data?

(a) The chi-squared ($\chi^2$) test can be used to test association between two categorical variables.
(b) $P$-values are not appropriate for categorical data.
(c) Confidence intervals cannot be calculated.
(d) Cells of an $r \times c$ table must all contain observed counts of at least 5.
(e) McNemar’s test can only be used for testing associations between two independent variables.

10. The methods section of a paper published in *Fertility and Sterility* reported:
“The 298 patients were randomly divided into treatment and control groups. The treatment group (149 patients; mean [±SD] age, 35.9 ± 4.2 years) received a daily oral dose of 100 mg of aspirin, and the control group (149 patients; mean age, 35.4 ± 3.9 years) received placebo. Both groups started aspirin or placebo treatment on the 21st day of their preceding menstrual cycle.”
The table below is among those published in the same paper.
Look at the sample sizes quoted in the extract and then in the table. Which one of the following statements can be made, using this information?

(a) More people were in the control group, than in the aspirin group.
(b) The mean age of each group given in the extract and then in the tables was based on sample sizes of 149 people in each group.
(c) The results in the table were based on data from all 298 women.
(d) A power calculation was used to determine what sample size would be needed.
(e) The methods section reports different sample sizes to the table.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Treatment group</th>
<th>Control group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 35)</td>
<td>(n = 39)</td>
<td></td>
</tr>
<tr>
<td>Mean age (y)</td>
<td>35.9 ± 4.2</td>
<td>35.4 ± 3.9</td>
<td>NS</td>
</tr>
<tr>
<td>Cancellation rate (%)</td>
<td>4</td>
<td>9</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>No. of follicles</td>
<td>19.8 ± 7.2</td>
<td>10.2 ± 5.3</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>No. of oocytes retrieved</td>
<td>16.2 ± 6.7</td>
<td>8.6 ± 4.6</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>E&lt;sub&gt;2&lt;/sub&gt; level (pg/mL)</td>
<td>2.923.8 ± 1.023.4</td>
<td>1.614.3 ± 791.7</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>No. of embryos transferred</td>
<td>3.3</td>
<td>3.3</td>
<td>NS</td>
</tr>
<tr>
<td>Implantation rate (%)</td>
<td>17.8</td>
<td>9.2</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Clinical PR (%)</td>
<td>45</td>
<td>28</td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>

Note: Values are means ± SD unless otherwise indicated. PR = pregnancy rate. NS = not significant.
Answer key: the correct options are:

1 d)  2 c)  3 c)  4 c)  5 c)  6 a)  7 b)  8 b)  9 a)  10 e)