Question 1 (7 marks)

Refer to Example 18.2

In a sample of 85 teenagers, 14 were classified as Vitamin C deficient.

(a) Find a 95% confidence interval for the true proportion of teenagers with vitamin C deficiency.

(b) Is it reasonable to claim that 20% of teenagers will be deficient in vitamin C? Using the result in a), explain your answer.

(c) What sample size is needed to estimate the true proportion with 95% confidence and a margin of error of no more than 0.05? Use the original sample data as your estimate for p.

Hint: Equation (18.2) can be rewritten as \( \hat{p} \pm \text{margin of error}. \) Use the margin of error to solve for \( n \) in (c).

Question 2 (8 marks)

Refer to Examples 19.1, 19.2, 19.3 & 19.6

It is claimed that a new treatment for prolonging the lives of cancer patients is more effective than the standard one. The mean survival period for patients on the standard treatment is 4.3 years.

The new treatment is administered to 20 patients and their survival times are recorded and summarized below:

<table>
<thead>
<tr>
<th>n</th>
<th>( \bar{x} )</th>
<th>s</th>
<th>( se(\bar{x}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>4.9</td>
<td>1.1</td>
<td>0.25</td>
</tr>
</tbody>
</table>

(a) Is there statistical evidence that taking the new treatment improves survival time? Show all calculations clearly and give a concise conclusion.

(b) Calculate a 95% confidence interval for the mean survival time (after taking the new treatment).

(c) Explain the relationship between (a) and (b), with specific reference to this problem.
Question 3 (5 marks)

In an experiment to compare two diets for fattening beef steers, nine pairs of animals were chosen from the herd; members of each pair were matched as closely as possible with respect to hereditary factors. The members of each pair were randomly allocated, one to each diet. The following table shows the weight gains (lbs) of the animals over a 140 day period: are given below:

<table>
<thead>
<tr>
<th>Pair</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>diet1</td>
<td>596</td>
<td>422</td>
<td>524</td>
<td>454</td>
<td>538</td>
<td>552</td>
<td>478</td>
<td>564</td>
<td>556</td>
</tr>
<tr>
<td>diet2</td>
<td>498</td>
<td>460</td>
<td>468</td>
<td>458</td>
<td>530</td>
<td>482</td>
<td>528</td>
<td>598</td>
<td>456</td>
</tr>
</tbody>
</table>

Using R

(a) Test for a difference between diets.

(b) Calculate a 90% confidence interval for the difference.

(c) Write an informative conclusion.


Question 4 (5 marks)

An experiment was conducted to evaluate the effectiveness of a treatment for tapeworm in the stomachs of sheep. A random sample of 24 worm-infected lambs of approximately the same age and health was randomly divided into two groups. Twelve were injected with the drug and the remaining twelve were left untreated. After a 6 month period the following worm counts were recorded.

<table>
<thead>
<tr>
<th>Treated</th>
<th>18</th>
<th>43</th>
<th>28</th>
<th>50</th>
<th>16</th>
<th>32</th>
<th>13</th>
<th>35</th>
<th>38</th>
<th>33</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>40</td>
<td>54</td>
<td>26</td>
<td>63</td>
<td>21</td>
<td>37</td>
<td>39</td>
<td>23</td>
<td>48</td>
<td>58</td>
<td>28</td>
<td>39</td>
</tr>
</tbody>
</table>

(Source: Ott & Longnecker, 2001, An Introduction to Statistical Methods and Data Analysis (5th edn), Duxbury)

(a) Explain how this design differs from the design used in Q3. That is, explain why one uses the paired t-test and the other uses an independent two-sample t-test.

(b) Use R to perform the test of significance and find a 95% confidence interval for the true difference in means.

(c) Write an informative conclusion.