Running a commercial airline is a highly complex business: you not only require efficient utilisation of your aircraft (each one is a multi-million pound investment), but also need to fill each plane with passengers and have sufficient crew members (whose working hours are strictly monitored). A Boeing 747 with Singapore Airlines, for example, requires a total crew of about 18 people to fly the plane and look after the passengers on a long distance journey.

As an example, consider the Singapore-London route. The journey time, on average, is

\[
\begin{align*}
\text{Singapore-London} & : 13 \text{ hours 35 minutes} \\
\text{London-Singapore} & : 13 \text{ hours}
\end{align*}
\]

(the difference in times is due to the prevailing westerly winds round the globe).

**Problem 1**

In September, Flight No. SQ320 leaves Singapore at 12.30 hours, local time. At what time will it arrive at London, local time, given that Singapore time is 7 hours ahead of London time?

**Problem 2**

Here are some possible departure times for flights from Singapore to London. Copy and complete the table, filling in the missing times.

<table>
<thead>
<tr>
<th>Singapore (local time) departs</th>
<th>07.30</th>
<th>10.00</th>
<th>12.30</th>
<th>15.00</th>
<th>17.30</th>
<th>20.00</th>
<th>22.30</th>
</tr>
</thead>
</table>

**Problem 3**

Suppose the airline has decided to run 3 daily flights from Singapore to London. Design a possible schedule that gives convenient departure and arrival times for passengers.

**Problem 4**

Each plane requires at least 3 hours at each airport, for disembarking, cleaning, refuelling, passenger boarding and luggage loading.

(a) Design a possible complete schedule for

\[
\text{Singapore-London-Singapore}
\]

for three daily services each day of the week, in each direction. How many planes are needed to cover this schedule?

(b) Design a possible schedule using only four planes.
In practice, each plane is not used exclusively for one specific route; a Singapore-London-Singapore plane might go to another destination on its next flight from Singapore.

**Problem 5**
You have 12 planes to allocate exclusively on Singapore to Europe services in September. Possible destinations and flying times are given in the table below.

<table>
<thead>
<tr>
<th>Destination</th>
<th>Flying time from Singapore</th>
<th>Flying time to Singapore</th>
<th>Time difference from Singapore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amsterdam</td>
<td>13 h 15 m</td>
<td>12 h 35 m</td>
<td>– 6 h</td>
</tr>
<tr>
<td>Frankfurt</td>
<td>13 h</td>
<td>12 h 25 m</td>
<td>– 6 h</td>
</tr>
<tr>
<td>London</td>
<td>13 h 35 m</td>
<td>13 h</td>
<td>– 7 h</td>
</tr>
<tr>
<td>Paris</td>
<td>13 h 25 m</td>
<td>12 h 30 m</td>
<td>– 6 h</td>
</tr>
<tr>
<td>Zurich</td>
<td>13 h</td>
<td>12 h 15 m</td>
<td>– 6 h</td>
</tr>
</tbody>
</table>

Design a suitable weekly schedule for these planes, taking into account the likely passenger demand for each destination.