Questions

1.   **Define the useful load:**

        a.   traffic load plus dry operating mass
        b.   traffic load plus usable fuel mass
        c.   dry operating mass plus usable fuel load
        d.   that part of the traffic load which generates revenue

2.   **Determine the position of the CG as a percentage of the MAC given that the balance arm of the CG is 724 and the MAC balance arms are 517 to 1706.**

        a.   14.2%
        b.   15.3%
        c.   16.3%
        d.   17.4%

3.   **The distance from the datum to the CG is:**

        a.   the index
        b.   the moment
        c.   the balance arm
        d.   the station

4.   **Use CAP 696, MRJT1, fig 4.9. What is the balance arm, the maximum compartment load and the running load for the most aft compartment of the fwd cargo hold?**

        a.   421.5 cm   3305 kg   13.12 kg per inch
        b.   1046.5 inches   711 kg   7.18 kg per kg
        c.   421.5 inches   2059 kg   13.12 kg per inch
        d.   1046.5 m   711 kg   7.18 kg per in

5.   **If the maximum structural landing mass is exceeded:**

        a.   the aircraft will be unable to get airborne
        b.   the undercarriage could collapse on landing
        c.   no damage will occur providing the aircraft is within the regulated landing mass
        d.   no damage will occur providing the aircraft is within the performance limited landing mass

6.   **Use CAP 696, MRJT1 as appropriate. Prior to departure an MRJT is loaded with maximum fuel of 20 100 L at an SG of 0.78. Calculate the maximum allowable traffic load that can be carried given the following data:**
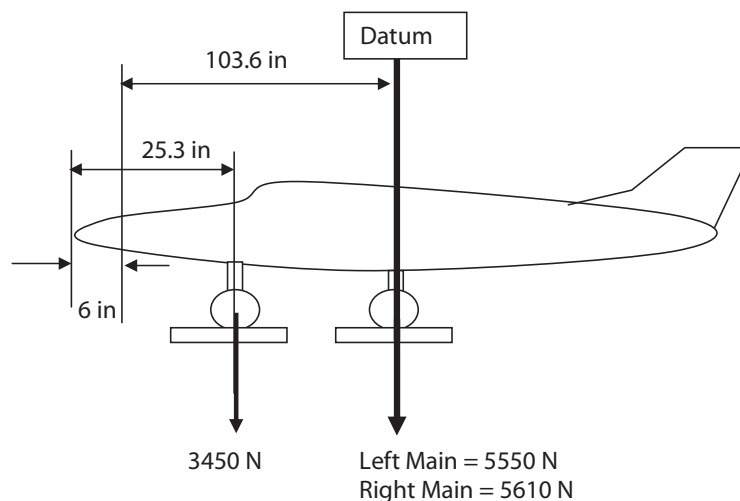
PLTOM	**62 800 kg**
PLLM	**54 200 kg**
DOM	**34 930 kg**
Taxi fuel	**250 kg**
Trip fuel	**9 250 kg**
Contingency and holding fuel	**850 kg**
Alternate fuel	**700 kg**

        a.   13 092 kg
        b.   12 442 kg
        c.   16 370 kg
        d.   16 842 kg

7. **Use CAP 696, fig 4.13. Assuming the fuel index moves minus 5.7 from the ZFM index, what is the take-off CG as a percentage of the MAC?**

    a. 20.1%
    b. 19.1%
    c. 23.0%
    d. 18.2%

8. **For a conventional light aeroplane with a tricycle undercarriage configuration, the higher the take-off mass:**

    1. **stick forces at rotation will increase**
    2. **range will decrease but endurance will increase**
    3. **gliding range will reduce**
    4. **stalling speed will increase**

    a. all statements are correct
    b. statement 3 only is correct
    c. statements 1 and 4 only are correct
    d. statement 4 only is correct

9. **Due to a mistake in the load sheet the aeroplane is 1000 kg heavier than you believe it to be. As a consequence:**

    a. V_1 will be later
    b. V_{MU} will be later
    c. V_R will be later
    d. V_1, V_{MU}, V_R will all occur earlier

10. **If the aeroplane was neutrally stable this would suggest that:**

    a. the CG is forward
    b. the CG is in mid range
    c. the CG is on the rear limit
    d. the CG is behind the rear limit

11. **The CG position is:**

    a. set by the pilot
    b. set by the manufacturer
    c. able to exist within a range
    d. fixed

12. **Which of the following has the least effect on the CG?**

    a. Cabin crew members performing their normal duties
    b. Fuel usage
    c. Stabilator trim setting
    d. Mass added or removed at the neutral point

13.   **Using the data for the MRJT 1 in CAP 696, what is the CG as a percentage of the MAC if the CG is 650 inches from the datum?**

   a.   17.03%
   b.   18.14%
   c.   19.25%
   d.   20.36%

14.   **The datum has to be along the longitudinal axis:**

   a.   between the nose and the tail
   b.   between the leading and trailing edge of the MAC
   c.   but does not have to be between the nose and the tail
   d.   at the firewall

15.   **The CG is:**

   a.   the point on the aircraft where the datum is located
   b.   the point on the aircraft at which gravity appears to act
   c.   the point on the aircraft from where the dihedral angle is measured
   d.   the point on the aircraft where the lift acts through

16.   **The aircraft basic mass and CG position details are found on:**

   a.   the weighing schedule and the aeroplane must be re-weighed if equipment change causes a change in mass or balance
   b.   on the loading manifest and is DOM – traffic load
   c.   on the loading manifest and is ZFM – useful load
   d.   on the weighing schedule and in the aeroplane technical log, and are adjusted to take account of any mass changes

17.   **When determining the mass of fuel/oil and the value of the SG is not known, the value to use is:**

   a.   determined by the operator (and laid down in the aeroplane OPS Manual. A pilot simply has to look it up)
   b.   set out in EU-OPS Section 1 Subpart J
   c.   determined by the aviation authority
   d.   determined by the pilot

18.   **In mass and balance terms, what is an index?**

   a.   A cut down version of a force
   b.   A moment divided by a constant
   c.   A moment divided by a mass
   d.   A mass divided by a moment

19.   **Standard masses for baggage can be used when there are:**

   a.   9 seats or more
   b.   20 seats or more
   c.   30 seats or more
   d.   less than 30 seats

20. **What is the zero fuel mass?**

a.   MSTOM minus fuel to destination minus fuel to alternative airfield
b.   Maximum allowable mass of the aircraft with no usable fuel on board
c.   Operating mass minus the fuel load
d.   Actual loaded mass of the aircraft with no usable fuel on board

21. **If an aeroplane comes into land below its MSLM but above the PLLM for the arrival airfield:**

1.   **airframe structural damage will occur**
2.   **tyre temperature limits could be exceeded**
3.   **it might not have sufficient runway length in which to stop safely**
4   **a go-around might not be achievable**
5.   **brake fade could occur**

a.   all the answers are correct
b.   3 and 4 only are correct
c.   2, 3, 4 and 5 only are correct
d.   1, 3, 4 and 5 only are correct

22. **A twin engine aeroplane of mass 2500 kg is in balanced level flight. The CG limits are 82 in to 95 in from the nose position of the aeroplane and the CG is approximately mid range. A passenger of mass 85 kg, moves from the front seat 85.5 inches aft of the nose to the rear seat 157.6 inches from the nose. What is the new CG position approximately?**

a.   2.5 inches
b.   87.5 inches
c.   91 inches
d.   92.5 inches

23. **Calculate the Basic Empty Mass and CG position for the MEP1 shown below:**

Datum

103.6 in

25.3 in

6 in

3450 N   Left Main = 5550 N
               Right Main = 5610 N

a.   BEM = 1489 kg and CG is 20 inches forward of datum
b.   BEM = 1456 kg and CG is 20 inches aft of the nose
c.   BEM = 1489 kg and CG is 20 inches aft of datum
d.   BEM = 1456 kg and CG is 89.6 inches aft of the nose

24. **A twin engine aeroplane is certified for a MSTOM and a MSLM of 58 000 kg and 55 000 kg respectfully. What is the limiting take-off mass for the aeroplane?**

PLTOM	61 000 kg
PLLM	54 000 kg
MZFM	36 000 kg
Operating mass	55 000 kg
Trip fuel	36 000 kg
Alternative fuel	500 kg
Final reserve	500 kg
Flight duration	3 hours
Fuel consumption	500 kg per hour per engine
Useful load	41 500 kg

    a.   58 000 kg
    b.   61 000 kg
    c.   56 145 kg
    d.   56 545 kg

Refer to CAP 696 for answers to 25, 26 and 27.

25. **With reference to CAP 696 figure 4.9, the centroid of the forward hold is:**

    a.   half way between stations 228 and station 500
    b.   314.5 inches forward of the aft cargo bay centroid
    c.   367.9 inches from the datum
    d.   367.9 inches from the nose of the aeroplane

26. **The distance of the leading edge of the wing MAC from the datum is:**

    a.   undefined
    b.   525.6 m
    c.   625.6 in
    d.   525.6 in

27. **What is the CG as a percentage of the MAC of the fully loaded aircraft?**

BEM	12 000 kg
Arm	3 m
CG	25% MAC
MAC	2 m
Item	Balance arm
Front seats	2.5 m
Rear seats	3 m
Fuel @ 0.74	410 L
Fuel arm	2.5 m
Rear seats	Empty
Pilot	80 kg
Front seat Pax	80 kg

    a.   16%
    b.   19%
    c.   21%
    d.   24%

28. The maximum aircraft mass excluding all usable fuel is:

   a.   fixed and listed in the aircraft's Operations Manual
   b.   variable and is set by the payload for the trip
   c.   fixed by the physical size of the fuselage and cargo holds
   d.   variable and depends on the actual fuel load for the trip

29. Just prior to take-off, a baggage handler put an extra box of significant mass into the hold without recording it in the LMCs. What are the effects of this action? The aeroplane has a normal, tricycle undercarriage.

   1.   VMC will increase if the extra load is forward of the datum
   2.   Stick forces in flight will decrease if the extra load is behind the datum
   3.   Stick forces at VR will increase if the box is forward of the main wheels
   4.   VMU will occur later
   5.   The safe stopping distance will increase

   a.   3, 4 and 5 only
   b.   2, 3 and 4 only
   c.   1 and 5 only.
   d.   all the above

30. What is the maximum take-off mass given:

MSTOM	43 000 kg
MSLM	35 000 kg
PLLM	33 000 kg
MZFM	31 000 kg
DOM	19 000 kg
Total Fuel capacity	12 500 kg
Maximum Trip Fuel	9000 kg
Contingency fuel	1000 kg
Alternate fuel	500 kg
Final reserve fuel	400 kg

   a.   43 000 kg
   b.   42 000 kg
   c.   41 000 kg
   d.   40 000 kg

31. What is the maximum mass an aeroplane can be loaded to before it moves under its own power?

   a.   Maximum structural ramp mass
   b.   Maximum structural take-off mass
   c.   Maximum regulated ramp mass
   d.   Maximum regulated take-off mass

32. The weight of an aircraft in all flight conditions acts:

   a.   parallel to the CG
   b.   at right angles to the aeroplane's flight path
   c.   always through the MAC
   d.   vertically downwards

33.   With reference to MRJT1 Load and Trim Sheet (CAP 696 Section 4 Page 11). If the
        DOM is 35 000 kg and the CG is 14%, what is the DOI?

        a.   41.5
        b.   33
        c.   40
        d.   30

34.   If the CG moves rearwards during flight:

        a.   range will decrease
        b.   range will increase
        c.   stability will increase
        d.   range will remain the same but stalling speed will decrease

35.   The CG of an aeroplane is situated at 115.8 arm and the mass is 4750 kg. A weight
        of 160 kg is moved from a hold situated at 80 arm to a hold at 120 arm. What
        would be the new CG arm?

        a.   117.14
        b.   118.33
        c.   118.50
        d.   120.01

36.   What is the effect of moving the CG from the front to the rear limit at constant
        altitude, CAS and temperature?

        a.   Reduced optimum cruise range
        b.   Reduced cruise range
        c.   Increased cruise range
        d.   Increased stall speed

37.   The baggage compartment floor-loading limit is 650 kg/m². What is the maximum
        mass of baggage that can be placed in the baggage compartment on a pallet of
        dimensions 0.8 m by 0.8 m if the pallet has a mass of 6 kg?

        a.   416 kg
        b.   1015 kg
        c.   650 kg
        d.   410 kg

38.   An aeroplane of 110 000 kg has its CG at 22.6 m aft of the datum. The CG limits are
        18 m to 22 m aft of the datum. How much mass must be removed from a hold 30 m
        aft of the datum to bring the CG to its mid point?

        a.   26 800 kg
        b.   28 600 kg
        c.   86 200 kg
        d.   62 800 kg

39.   Where does the mass act through when the aircraft is stationary on the ground?

        a.   The centre of gravity
        b.   The main wheels
        c.   It doesn't act through anywhere
        d.   The aerodynamic centre

40. **If an aircraft is weighed prior to entry into service, who is responsible for doing the re-weigh to prepare the plane for operations?**

    a.   The manufacturer
    b.   The operator
    c.   The pilot
    d.   The flight engineer

41. **An aeroplane has a tank capacity of 50 000 imperial gallons. It is loaded with fuel to a quantity of 165 000 kg (790 kg/m³). What is the specific gravity of the fuel and approximately how much more fuel could be taken up given that mass limits would not be exceeded?**

    a.   0.73   46 053 gallons
    b.   0.81   4050 gallons
    c.   0.72   46 000 gallons
    d.   0.79   4056 gallons

42. **Define Balance Arm:**

    a.   BA = Mass / Moment
    b.   BA = Moment / Mass
    c.   BA = Mass / Distance
    d.   BA = Moment / Distance

43. **You have been given 16 500 litres of fuel at SG 0.78 but written down is 16 500 kg. As a result you will experience:**

    a.   heavier stick forces at rotation and improved climb performance
    b.   heavier stick forces on rotation and distance to take-off increases
    c.   lighter stick forces on rotation and calculated V_1 will be too high
    d.   lighter stick forces on rotation and V_2 will be too low

Specimen Examination Paper

1. **Define the useful load:**

    a.   traffic load plus dry operating mass
    b.   traffic load plus usable fuel mass
    c.   dry operating mass plus usable fuel load
    d.   that part of the traffic load which generates revenue

2. **Determine the position of the CG as a percentage of the MAC given that the balance arm of the CG is 724 and the MAC balance arms are 517 to 1706:**

    a.   14.2%
    b.   15.3%
    c.   16.3%
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3. **The distance from the datum to the CG is:**

    a.   the index
    b.   the moment
    c.   the balance arm
    d.   the station

4. **Use CAP 696, MRJT 1, fig 4.9. What is the balance arm, the maximum compartment load and the running load for the most aft compartment of the fwd cargo hold?**

    a.   421.5 cm   3305 kg   13.12 kg per inch
    b.   1046.5 inches   711 kg   7.18 kg per kg
    c.   421.5 inches   2059 kg   13.12 kg per inch
    d.   1046.5 m   711 kg   7.18 kg per in

5. **Individual aircraft should be weighed in an air conditioned hangar:**

    a.   on entry into service and subsequently every 4 years
    b.   when the effects of modifications or repairs are not known
    c.   with the hangar doors closed and the air conditioning off
    d.   all the above

6. **If a compartment takes a maximum load of 500 kg, with a running load limit of 350 kg/m and a distribution load limit of 300 kg/m² max, which of the following boxes, each of 500 kg, can be carried?**

    1.   **100 cm × 110 cm × 145 cm**
    2.   **125 cm × 135 cm × 142 cm**
    3.   **120 cm × 140 cm × 143 cm**
    4.   **125 cm × 135 cm × 144 cm**

    a.   Any one of the boxes if loaded with due care as to its positioning
    b.   Either of boxes 2, 3 and 4 in any configuration
    c.   Box 2 with its longest length perpendicular to the floor cross beam or box 3 in any configuration
    d.   Either of boxes 3 and 4 with their longest length parallel to the aircraft longitudinal axis

7.   Use CAP 696, Section 4, MRJT1, as appropriate. Prior to departure an MRJT is loaded with maximum fuel of 20 100 L at an SG of 0.78. Calculate the maximum allowable traffic load that can be carried given the following data:

PLTOM	67 200 kg
PLLM	54 200 kg
DOM	34 930 kg
Taxi fuel	250 kg
Trip fuel	9 250 kg
Contingency and holding fuel	850 kg
Alternate fuel	700 kg

   a.   13 092 kg
   b.   12 442 kg
   c.   16 370 kg
   d.   16 842 kg

8.   If the maximum structural landing mass is exceeded:

   a.   the aircraft will be unable to get airborne
   b.   the undercarriage could collapse on landing
   c.   no damage will occur providing the aircraft is within the regulated landing mass
   d.   no damage will occur providing the aircraft is within the performance limited landing mass

9.   For a conventional light aeroplane with a tricycle undercarriage configuration, the higher the take-off mass:

   1.   stick forces at rotation will increase.
   2.   range will decrease but endurance will increase.
   3.   gliding range will reduce.
   4.   stalling speed will increase.

   a.   all statements are correct
   b.   statement 3 only is correct
   c.   statements 1 and 4 only are correct
   d.   statement 4 only is correct

10.   Due to a mistake in the load sheet the aeroplane is 1000 kg heavier than you believe it to be. As a consequence:

   a. V_1 will be later
   b. V_{MU} will be later
   c. V_R will be later
   d. V_1, V_{MU}, V_R will all occur earlier

11.   If the aeroplane was neutrally stable this would suggest that:

   a.   the CG is forward
   b.   the CG is in mid range
   c.   the CG is on the rear limit
   d.   the CG is behind the rear limit

12.   **The CG position is:**

      a.   set by the pilot
      b.   set by the manufacturer
      c.   able to exist within a range
      d.   fixed

13.   **Which of the following would not affect the CG position?**

      a.   Cabin crew members performing their normal duties
      b.   Fuel consumption during flight
      c.   Horizontal stabilator trim setting
      d.   Mass added or removed at the neutral point

14.   **An aircraft is about to depart on an oceanic sector from a high elevation airfield with an exceptionally long runway in the tropics at 1400 local time. The regulated take-off mass is likely to be limited by:**

      a.   MZFM
      b.   Obstacle clearance
      c.   Maximum certified take-off mass
      d.   Climb gradient

15.   **An aircraft is flying at $1.3V_{S1g}$ in order to provide an adequate margin above the low speed buffet and transonic speeds. If the $1.3V_{S1g}$ speed is 180 kt CAS and the mass increases from 285 000 kg to 320 000 kg, what is the new 1g stalling speed?**

      a.   146.7 kt, drag will increase and nautical mile per kg fuel burn will decrease
      b.   191 kt, drag will increase and range NM/kg will increase
      c.   191 kt, drag will increase and NM/kg fuel burn will decrease
      d.   147 kt, drag will remain the same and NM/kg fuel burn will increase

16.   **The datum for the balance arms has to be along the longitudinal axis:**

      a.   between the nose and the tail
      b.   between the leading and trailing edge of the MAC
      c.   but does not have to be between the nose and the tail
      d.   at the fire wall

17.   **The useful load is:**

      a.   TOM – fuel mass
      b.   BEM plus fuel load
      c.   TOM minus the DOM
      d.   TOM minus the operating mass

18.   **In Mass & Balance terms, what is an index?**

      a.   A cut down version of a force
      b.   A moment divided by a constant
      c.   A moment divided by a mass
      d.   A mass divided by a moment

19. **Standard masses for baggage can be used for aircraft with:**

    a. 9 seats or more
    b. 20 seats or more
    c. 30 seats or more
    d. less than 30 seats

20. **If an aeroplane comes into land below its MSLM but above the PLLM for the arrival airfield:**

    1. **airframe structural damage will occur**
    2. **tyre temperature limits could be exceeded**
    3. **the runway length might be inadequate**
    4 **a go-around might not be achievable**
    5. **brake fade could occur**

    a. 1 and 5 only
    b. 3 and 4 only
    c. 2, 3, 4 and 5 only
    d. 1, 3, 4 and 5 only

21. **What is the zero fuel mass?**

    a. MSTOM minus fuel to destination minus fuel to alternative airfield
    b. Maximum allowable mass of the aircraft with no usable fuel on board
    c. Operating mass minus the fuel load
    d. Actual loaded mass of the aircraft with no usable fuel on board

22. **An aeroplane develops a serious maintenance problem shortly after take-off and has to return to its departure airfield. In order to land safely the aircraft must jettison fuel. How much fuel must be jettisoned?**

    a. Sufficient to reduce the mass to the zero fuel mass
    b. The pilot calculates the amount of fuel to jettison to reduce the mass to a safe level at or below the RLM
    c. The fuel system automatically stops the jettison at the RLM
    d. As much as the pilot feels is just insufficient to land safely

23. **Calculate the amount of cargo that could be loaded into the aircraft given the following information and using CAP 696, Section 4, MRJT1, as necessary:**

Dry Operating Mass	**34 900 kg**
Performance Limited Landing Mass	**55 000 kg**
Trip Fuel	**9 700 kg**
Contingency Fuel	**1200 kg**
Alternate Fuel	**1400 kg**
130 passengers at 84 kg each	**10 920 kg**
130 bags at 14 kg each	**1820 kg**

    a. 2860 kg
    b. 3660 kg
    c. 4660 kg
    d. 5423 kg