Problem 1

Aircraft Weight Characteristics		Weight (lbs)
Maximum Structural Take off weight		220000
Maximum Strucutral Landing Weight		198000
Zero fuel weight		182513
Operating empty weight		125513
Maximum structural payload		57000
Fuel capacity		75400
Reserve fuel	**1.25 h**	
Average speed	**540 mile/h**	
Fuel burning	**22.8 lbs/mile**	

Prob: Payload

Range = Trip fuel / burn fuel

1) Range when payload is max:

MTOW = OEW + Max. Payload + Allowable fuel

220000 = 125513 + 57000 + Allowable fuel

Allowable fuel = 37487 lbs

Allowable fuel = Trip fuel + Reserve fuel

37487 = Trip fuel + 15390

Trip fuel = 22097 lb

Reserve fuel = time × speed × fuel burn rate

= 1.25 × 540 × 22.8

= 15390 lbs

Range = Trip fuel / burn fuel = 22097 / 22.8

Range = 969 miles

Landing wt. + Trip fuel = MTOW

Landing wt. = MTOW − Trip fuel

= 220000 − 22097

= 197903 < MLW (OK)

2) Range when fuel is max:

MTOW = OEW + Payload + Allowable fuel

220000 = 125513 + Payload + 75400

Payload = 19087 lbs

Allowable fuel = Trip fuel + Reserve fuel

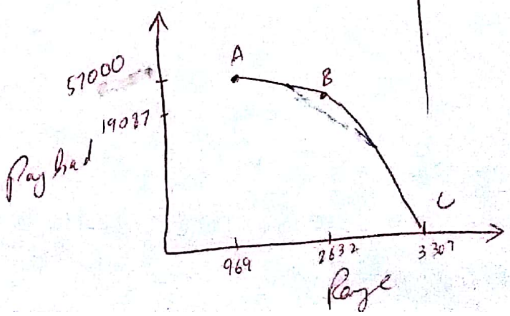
Trip fuel = 75400 − 15390

Trip fuel = 60010 lbs

Reserve fuel = 15390 lbs

Range = Trip fuel / Burn fuel = 60010 / 22.8 =

Range = 2632 miles



3) Ferry range:

Ferry range = Trip fuel / burn fuel

= 75400 / 22.8

Range = 3307 mile

Problem 3

- Normal Take off Case
  - Lift off distance = 7000 ft
  - Distance to clear 35 ft height = 8000 ft
- Engine Failure
  - Lift off distance = 8200 ft
  - Distance to clear 35 ft height = 9100 ft
- Engine failure aborted take off
  - Accelerate stop distance = 9500 ft
- Normal Landing
  - Stop distance = 5000 ft
- Determine the length of the runway

Prob 3

1) Normal take off case:

LOD = 7000 ft

D_{35} = 35 ft obstacle = 8000 ft

$TOD_1 = 1.15 \times 8000 = 9200$ ft

$CL_1 = 0.5 [TOD - 1.15\ LOD]$

$= 0.5 [9200 - 1.15 \times 7000]$

$= 575$ ft

$FS = TOR = TOD - CL$

$= 9200 - 575 = 8625$ ft

$FL = FS + CL$

$= 8625 + 575$

$= 9200$ ft

$FL = TOD$

2) Engine failure

LOD = 8200 ft

$D_{35} = 9100$ ft

$TOD_2 = (D_{35})_2 = 9100$

$CL_2 = 0.5 [TOD - LOD)$

$= 0.5 [9100 - 8200]$

$= 450$ ft

$FS_2 = TOR = TOD - CL$

$= 9100 - 450$

$= 8650$ ft

$FL = FS + CL$

$= 8650 + 450$

$= 9100$

$FL = TOD$

3) Engine failure aborted take off

ASD = 9500 ft

FL = 9500 ft

$FL = ASD = DAS$

4) Normal landing

SD = 5000 ft

$FL = LD = \frac{SD}{0.6}$

$= 8333.3$ ft

$FL = \frac{SD}{0.6}$

Length of runway = max = 9500 ft

1) $F.L = \max(TOD_1, TOD_2, DAS, LD) = \max(9200, 9100, 9500, 8333.3) = 9500$ ft

2) $F.S = \max(TOR_1, TOR_2, L.D) = \max(9200, 9100, 8333.3) = 9200$ ft

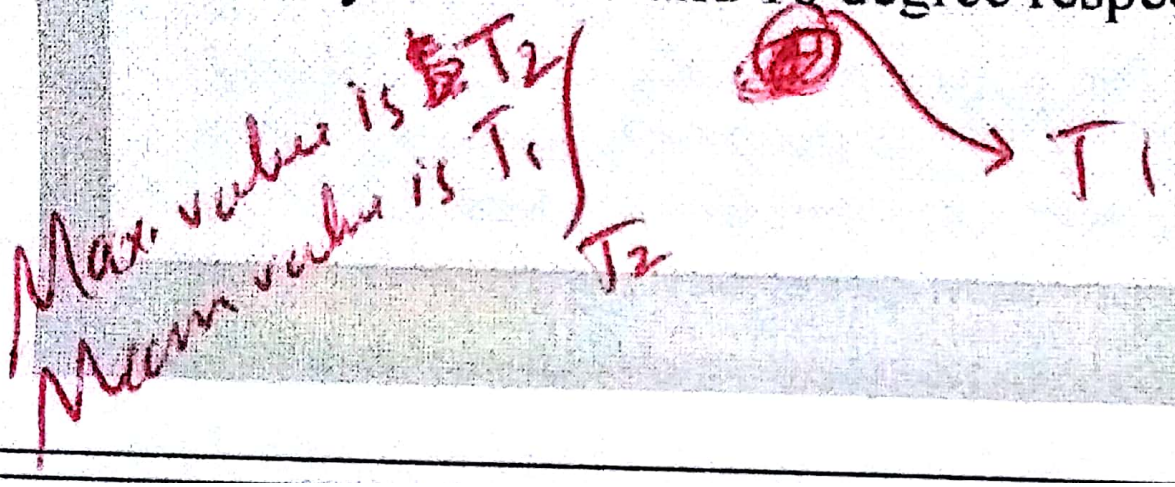
3) $SW = DAS - \max(TOR_1, TOR_2, L.D) = 9500 - \max(9200, 9100, 8333.3) = 300$ ft

4) $SW_{min} = 0$, 6) $CL_{min} = 0$ 7) $CL_{max} = 1000$ ft

5) $CL = \min(FL - DAS, CL_{1\,max}, CL_{2\,max})$

Problem 5

- Find out the length of runway having field length of 1800 m. The airport is located 450 m above mean sea level. The runway effective gradient is 0.5%. The monthly mean maximum and mean daily temperature of hottest month of the year are 27 and 18 degree respectively.



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Data:

Length of Runway = ?

F.L = 1800m

Elevation above MSL = 450m

Effective gradient = 0.5%

Mean max Monthly T = 27°C = T_2

Mean daily T = 18°C = T_1

Sol:

Elevation correction:

$F_e = 0.07 \times \frac{E}{300} + 1$

$= 0.07 \times \frac{450}{300} + 1$

$= 1.105$

Temperature correction

$T = T_1 + \frac{T_2 - T_1}{3}$

$= 18 + \frac{27 - 18}{3}$

$= 21°C$

~~Standard Temp at air port site~~

$F_t = 0.01[T - (15 - \frac{6.5E}{1000})] + 1$

$= 0.01[21 - (15 - \frac{6.5 \times 450}{1000})] + 1$

$F_t = 1.09$

Gradient correction

Gradient = 0.5%

$F_g = 0.1g + 1$

$= 0.1 \times 0.5 + 1$

$F_g = 1.05$

Corrected length

$L = (F_e \times F_t \times F_g)$ Original length

$= (1.105 \times 1.09 \times 1.05)1800$

$= 2276.4$ m