**PSY 653 Module 4: Inferences regarding fixed and random effects**

**Feb 19, 2020**

The following results are reported

**Source df SS MS**

A 2 200 100

B 3 160 53.33

C 2 400 200

AB 6 60 10

AC 4 80 20

BC 6 70 15

ABC 12 30 2.5

Error 684 420 2

1. Determine 𝜂2 values for each effect (Hint 𝜂2 = SSeffect/SSTotal)

|  |  |
| --- | --- |
| A | 0.1408450704 |
| B | 0.1126760563 |
| C | 0.2816901408 |
| A\*B | 0.04225352113 |
| B\*C | 0.04929577465 |
| A\*C | 0.05633802817 |
| A\*B\*C | 0.02112676056 |

1. How many total cells are there? (Hint: Identify how many levels in each variable)

**(2+1) \* (3 +1) \* (2 + 1) = 36 Total cells**

1. Subjects were divided evenly. How many subjects per cell? (Hint: Calculate the DFtotal)

**20**

1. **Assuming all factors are fixed**
   1. Create EMS table and EMS Equations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 𝜎2A | 𝜎2B | 𝜎2C | 𝜎2AB | 𝜎2AC | 𝜎2BC | 𝜎2ABC | 𝜎2Error |
| EMSA | 𝜎2A |  |  |  |  |  |  | 𝜎2error |
| EMSB |  | 𝜎2B |  |  |  |  |  | 𝜎2 error |
| EMSC |  |  | 𝜎2C |  |  |  |  | 𝜎2error |
| EMSAB |  |  |  | 𝜎2AB |  |  |  | 𝜎2 error |
| EMSAC |  |  |  |  | 𝜎2AC |  |  | 𝜎2error |
| EMSBC |  |  |  |  |  | 𝜎2BC |  | 𝜎2error |
| EMSABC |  |  |  |  |  |  | 𝜎2ABC | 𝜎2error |
| EMSError |  |  |  |  |  |  |  | 𝜎2error |

* 1. Identify variance components for all factors (i.e., write out the equations for each effect)

|  |  |
| --- | --- |
| EMSA | EMSA = nqr σ2A + σ2error |
| EMSB | EMSB = npr σ2B + σ2error |
| EMSC | EMSC = npq σ2C + σ2error |
| EMSAB | EMSAB = nr σ2AB + σ2error |
| EMSAC | EMSAC = nq σ2AC + σ2error |
| EMSBC | EMSBC = np σ2BC + σ2error |
| EMSABC | EMSABC = n σ2ABC + σ2error |
| EMSError | EMSerror = σ2error |

* 1. Plug in the weights for each effect and solve for the s2 effect (hint: this can be tedious, so using excel to calculate values could speed up the process)

|  |  |
| --- | --- |
| EMSA | (20\*4\*3\*σ2A) + 2 |
| EMSB | (20\*3\*3\*σ2B) + 2 |
| EMSC | (20\*3\*4\*σ2C) + 2 |
| EMSAB | (20\*3\*σ2AB) + 2 |
| EMSAC | (20\*4\*σ2AB) + 2 |
| EMSBC | (20\*3\*σ2BC) + 2 |
| EMSABC | (20\*σ2ABC) + 2 |
| EMSError | σ2error |

1. **Assuming A is fixed and B and C are random**
   1. Create EMS table and EMS Equations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 𝜎2A | 𝜎2B | 𝜎2C | 𝜎2AB | 𝜎2AC | 𝜎2BC | 𝜎2ABC | 𝜎2Error |
| EMSA | 𝜎2A |  |  | 𝜎2AB | 𝜎2AC |  | 𝜎2ABC | 𝜎2error |
| EMSB |  | 𝜎2 B |  |  |  | 𝜎2BC |  | 𝜎2error |
| EMSC |  |  | 𝜎2C |  |  | 𝜎2BC |  | 𝜎2error |
| EMSAB |  |  |  | 𝜎2AB |  |  | 𝜎2ABC | 𝜎2 error |
| EMSAC |  |  |  |  | 𝜎2AC |  | 𝜎2ABC | 𝜎2error |
| EMSBC |  |  |  |  |  | 𝜎2BC |  | 𝜎2 error |
| EMSABC |  |  |  |  |  |  | 𝜎2ABC | 𝜎2error |
| EMSError |  |  |  |  |  |  |  | 𝜎2error |

* 1. Identify variance components for all factors (i.e., write out the equations for each effect)

|  |  |
| --- | --- |
| EMSA | EMSA = nqr σ2A + nr σ2AB + nq σ2AC + n σ2ABC + σ2error |
| EMSB | EMSB = npr σ2B + np σ2BC + σ2error |
| EMSC | EMSC = npq σ2C + np σ2BC + σ2error |
| EMSAB | EMSAB = nr σ2AB + n σ2ABC + σ2error |
| EMSAC | EMSAC = nq σ2AC + n σ2ABC + σ2error |
| EMSBC | EMSBC = np σ2BC + σ2error |
| EMSABC | EMSABC = n σ2ABC + σ2error |
| EMSError | EMSerror = σ2error |

* 1. Plug in the weights for each effect and solve for the s2 effect (hint: this can be tedious, so using excel to calculate values could speed up the process)

|  |  |
| --- | --- |
| EMSA | (20\*4\*3\*σ2A) + (20\*3\*σ2AB) + (20\*4\*σ2AC) + (20\*σ2ABC) + 2 |
| EMSB | (20\*3\*3\*σ2B) + (20\*3\*σ2BC) + 2 |
| EMSC | (20\*3\*4\*σ2C) + (20\*3\*σ2BC) + 2 |
| EMSAB | (20\*3\*σ2BC) + (20\*σ2ABC) + 2 |
| EMSAC | (20\*4\*σ2AC) + (20\*σ2ABC) + 2 |
| EMSBC | (20\*3\*σ2BC) + (20\*σ2ABC) + 2 |
| EMSABC | (20\*σ2ABC) + 2 |
| EMSError | 2 |

1. **Assuming A, B, and C are random**
   1. Create EMS table and EMS Equations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 𝜎2A | 𝜎2B | 𝜎2C | 𝜎2AB | 𝜎2AC | 𝜎2BC | 𝜎2ABC | 𝜎2Error |
| EMSA | 𝜎2A |  |  | 𝜎2AB | 𝜎2AC |  | 𝜎2ABC | 𝜎2error |
| EMSB |  | 𝜎2B |  | 𝜎2AB |  | 𝜎2BC | 𝜎2ABC | 𝜎2error |
| EMSC |  |  | 𝜎2C |  | 𝜎2AC | 𝜎2BC | 𝜎2ABC | 𝜎2error |
| EMSAB |  |  |  | 𝜎2AB |  |  | 𝜎2ABC | 𝜎2error |
| EMSAC |  |  |  |  | 𝜎2AC |  | 𝜎2ABC | 𝜎2error |
| EMSBC |  |  |  |  |  | 𝜎2BC | 𝜎2ABC | 𝜎2error |
| EMSABC |  |  |  |  |  |  | 𝜎2ABC | 𝜎2error |
| EMSError |  |  |  |  |  |  |  | 𝜎2error |

* 1. Identify variance components for all factors (i.e., write out the equations for each effect)

|  |  |
| --- | --- |
| EMSA | nqrσ2A + nrσ2AB + nqσ2AC + nσ2ABC + σ2error |
| EMSB | nprσ2B + nrσ2AB + npσ2BC + nσ2ABC + σ2error |
| EMSC | npqσ2C + + nqσ2AC + npσ2BC + nσ2ABC + σ2error |
| EMSAB | nrσ2AB+ nσ2ABC + σ2error |
| EMSAC | nqσ2AC + nσ2ABC + σ2error |
| EMSBC | npσ2BC + nσ2ABC + σ2error |
| EMSABC | nσ2ABC + σ2error |
| EMSError | σ2error |

* 1. Plug in the weights for each effect and solve for the s2 effect (hint: this can be tedious, so using excel to calculate values could speed up the process)

|  |  |
| --- | --- |
| EMSA | (20\*4\*3\*σ2A) + (20\*3\*σ2AB) + (20\*4\*σ2AC) + (20\*σ2ABC) + 2 |
| EMSB | (20\*3\*3\*σ2B) + (20\*3\*σ2AB) + (20\*3\*σ2BC) + (20\*σ2ABC) + 2 |
| EMSC | (20\*3\*4σ2C) + (20\*4\*σ2AC) + (20\*3\*σ2BC) + (20\*σ2ABC) + 2 |
| EMSAB | (20\*3\*σ2AB) + (20\*σ2ABC) + 2 |
| EMSAC | (20\*4\*σ2AC) + (20\*σ2ABC) + 2 |
| EMSBC | (20\*3\*σ2BC) + (20\*σ2ABC) + 2 |
| EMSABC | (20\*σ2ABC) + 2 |
| EMSError | 2 |

1. How would you use these values to solve for F or Quasi F ratios? (You don’t need to actually solve these equations, unless you would like the algebra practice!)

Once you have solved for each σ2 effect then you would plug in the values within the F or Quasi F equation and obtain the F-value desired.