

# Statistical Methods II AEMA-610

## Assignment 8

Date 2020/11/06  
Date due 2020/11/13

A researcher is carrying out a genomic study on 4 different tissues (1, 2, 3, & 4) in humans (with appropriate ethics board approval). Tissue samples are collected from a random representative sample of 20 people, the DNA is extracted and purified and then 20 plates (each with 4 wells) are used to measure DNA up-regulation. Each plate receives the 4 different tissue samples from a person. The plates, with the pre-assigned necessary reagents were purchased from a single commercial supplier (to minimize any differences amongst the plates in their expression levels). The following data were recorded:

Obs	Individual	plate	tissue	Expression
1	1	1	1	21.3
2	1	1	2	22.3
3	1	1	3	20.5
4	1	1	4	22.2
5	2	2	1	16.9
6	2	2	2	21.7
7	2	2	3	22.0
8	2	2	4	24.1
9	3	3	1	22.5
10	3	3	2	21.3
11	3	3	3	22.1
12	3	3	4	23.4
13	4	4	1	19.0
14	4	4	2	21.5
15	4	4	3	19.3
16	4	4	4	21.2
17	5	5	1	21.8

<b>Obs</b>	<b>Individual</b>	<b>plate</b>	<b>tissue</b>	<b>Expression</b>
<b>18</b>	5	5	2	22.4
<b>19</b>	5	5	3	19.3
<b>20</b>	5	5	4	21.0
<b>21</b>	6	6	1	20.6
<b>22</b>	6	6	2	20.3
<b>23</b>	6	6	3	21.0
<b>24</b>	6	6	4	22.9
<b>25</b>	7	7	1	21.5
<b>26</b>	7	7	2	21.9
<b>27</b>	7	7	3	27.0
<b>28</b>	7	7	4	20.2
<b>29</b>	8	8	1	18.9
<b>30</b>	8	8	2	19.6
<b>31</b>	8	8	3	17.5
<b>32</b>	8	8	4	20.2
<b>33</b>	9	9	1	22.4
<b>34</b>	9	9	2	23.6
<b>35</b>	9	9	3	22.1
<b>36</b>	9	9	4	22.9
<b>37</b>	10	10	1	20.8
<b>38</b>	10	10	2	20.7
<b>39</b>	10	10	3	22.5
<b>40</b>	10	10	4	20.1
<b>41</b>	11	11	1	20.9
<b>42</b>	11	11	2	23.6
<b>43</b>	11	11	3	23.1
<b>44</b>	11	11	4	22.8
<b>45</b>	12	12	1	17.4
<b>46</b>	12	12	2	20.1

<b>Obs</b>	<b>Individual</b>	<b>plate</b>	<b>tissue</b>	<b>Expression</b>
<b>47</b>	12	12	3	19.4
<b>48</b>	12	12	4	19.4
<b>49</b>	13	13	1	22.2
<b>50</b>	13	13	2	23.5
<b>51</b>	13	13	3	22.3
<b>52</b>	13	13	4	21.9
<b>53</b>	14	14	1	19.1
<b>54</b>	14	14	2	20.0
<b>55</b>	14	14	3	21.5
<b>56</b>	14	14	4	20.2
<b>57</b>	15	15	1	18.4
<b>58</b>	15	15	2	21.3
<b>59</b>	15	15	3	19.4
<b>60</b>	15	15	4	18.9
<b>61</b>	16	16	1	15.5
<b>62</b>	16	16	2	19.0
<b>63</b>	16	16	3	19.3
<b>64</b>	16	16	4	20.8
<b>65</b>	17	17	1	21.3
<b>66</b>	17	17	2	21.3
<b>67</b>	17	17	3	23.7
<b>68</b>	17	17	4	21.6
<b>69</b>	18	18	1	21.6
<b>70</b>	18	18	2	21.6
<b>71</b>	18	18	3	20.0
<b>72</b>	18	18	4	23.1
<b>73</b>	19	19	1	20.8
<b>74</b>	19	19	2	22.3
<b>75</b>	19	19	3	23.0

<b>Obs</b>	<b>Individual</b>	<b>plate</b>	<b>tissue</b>	<b>Expression</b>
<b>76</b>	19	19	4	21.7
<b>77</b>	20	20	1	21.9
<b>78</b>	20	20	2	20.1
<b>79</b>	20	20	3	21.4
<b>80</b>	20	20	4	22.2

NOTE. Show sufficient calculations. Use a 5% probability level for all statistical tests.

Q1. Specify a suitable model for your analysis, define the terms and the parameters. 4 points

Q2. Specify in words and in matrix form (formal statistical notation) your various Null and Alternative Hypotheses. 3 points

Q3. Test which effect(s) can be considered to be statistically significant or not. Clearly answer, in words, what hypotheses you accept or reject. Clearly indicate any tabulated values (and their degrees of freedom) you use for each test. 10 points

Q4. Estimate the lsmeans that you consider appropriate and their differences. 6 points

Q5. Obtain a 95% Confidence Interval for your variance component(s). 4 points